Influence of Type of Graftage, Age of Plant, and Certain Environmental Factors on the Loss of Water by Young Mango Budlings

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By

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I. INTRODUCTION

Horticulturists have always assumed that graftage does not affect the transpiration loss of water by buddings except in the very early stages, less than a year after grafting. Yet no evidence seems ever to have been presented that even in the early period after grafting is there any effect of graftage on transpiration rates. In a letter dated June 19, 1952, Dr. Dean Akenhead, Director, Commonwealth Bureau of Horticulture and Plantation Crops, East Malling Research Station, England, indicated to the writer that there was apparently no published evidence to substantiate this view.

The world-wide importance of the mango (Mangifera indica L.) as a tropical fruit and its value as a potential large-scale crop in southeastern Florida made it a logical subject for investigation, particularly in view of the paucity of information on its water relations.

The objectives of the present research were four:

(1) To determine the magnitude of water loss by young mango buddings under greenhouse conditions.

(2) To determine the effect of time (days) after watering on water losses by buddings and seedlings grown in sealed and open containers.

(3) To determine how water losses are influenced by the type

of graftage (veneer graft, chip bud, and shield bud[1] with a seedling check) at different plant ages after graftage (approximately 19, 16, 7, and 4 weeks).

(4) To determine the effects of certain environmental factors (air temperature, vapor pressure deficit, wind velocity, light intensity, soil temperature, and leaf temperature) on water losses.

[1] One plant age, 16 weeks.

II. REVIEW OF THE LITERATURE

A. Water Loss

Literally thousands of articles have been published during the past three centuries on the various phases of transpiration and the factors affecting it. Many excellent general treatises, summaries, and reviews have appeared periodically, of which those by Miller (1938), Klages (1942), Reed (1942), Crafts, Currier, and Stocking (1949), Kramer (1949), Curtis and Clark (1950), Meyer and Anderson (1952), Richards and Wadleigh (1952), and Richards, Hagan, and McCalla (1952) are some of the most recent. Miller (1938) in particular has presented an exhaustive survey of water losses while Crafts, Currier, and Stocking (1949) have examined the entire field of plant water relations with emphasis on the internal phases. Both Crafts, Currier, and Stocking (1949) and Reed (1942) have taken prominent notice of the historical background underlying present-day investigations on the physiology of water in plants. Meyer and Anderson (1952) and Curtis and Clark (1950) have, like Miller, presented general surveys of transpiration in connection with other plant physiological processes. The older literature relating to the water requirement of plants has been summarized by Briggs and Shantz (1913a, b), Kiesselbach (1916) and Shantz and Piemeisel (1927).

Klages (1942) has given an extended review of various climatic factors in relation to crop production. Kramer (1949) has reviewed plant and soil water relationships from the standpoint of plant physiology, while Richards and Wadleigh (1952) have treated the same subject from the viewpoint of soil physics. Richards, Hagan, and McCalla (1953) have published an extensive summary of the influence of soil temperature on plant growth and behavior. Shirley (1945) and Parker and Borthwick (1950) have reviewed the effects of light on transpiration and other plant processes.

Bailey, Rothacher, and Cummings (1952) have recently provided a critical comparison of the cobalt chloride paper and gravimetric methods of measuring transpiration, using black oak (Quercus velutina), white oak (Q. alba), tobacco, geranium, and tomato seedlings as test plants. They concluded from their experiments that the cobalt chloride method was of qualitative significance only and could not be used for the quantitative measurement of moisture losses in field studies.

The above-mentioned authors all give more or less detailed accounts of the methods of measurement and types of experiments used in previous water loss studies. They have also presented general information as to the magnitude and variation of transpiration in many species of plants as well as of the effects of certain environmental factors so that elaboration of these points is unnecessary.

In conformity with the statement by Akenhead, mentioned in the Introduction, a search of the plant science literature has not revealed a single article concerning the effect of type of graftage on water loss by plants. One must perforce conclude that experimental evidence on this question probably does not exist. A nearly similar situation is true with regard to the water relationships of the mango. While data are available on requirements of the mango as to soil moisture, amount and distribution of rainfall, and air temperature from the standpoint of cultural practices in many parts of the world (Soule 1951a), a short paper by Luthra and Sharma (1946) on the conductivity and histology of young grafted mango shoots, made with inarched (approach-grafted) Langra seedlings in India, constitutes the present extent of knowledge on water loss from mangos.

B. Leaf Area Measurements

One of the most popular methods of reporting transpiration data has been on a basis of leaf area, since comparisons can be made much more readily than, for example, on green weight per leaf or some similar criterion.

Miller (1931) listed and described five methods for measuring leaf areas: (1) by tracing the outline of the leaf on paper and later measuring the enclosed area by means of a planimeter, (2) by tracing

the outline of the leaf on paper of known weight per unit area, (3) by photographing the leaf on sensitized paper and either measuring or weighing the enclosed area, (4) by rough measurement of the leaf and determining the area by direct calculation, and (5) by measurement with a photoelectric cell.

Darrow (1932) added three additional methods which had not been described previously: (1) the leaf-product method, (2) the matching method, and (3) the adjustable-platform planimeter method. The leaf-product method involved the measurement of leaf length and widths and correlating these values with area. The matching method involved cutting out the form to pasteboard or some other suitable material of the largest leaf measured; then the outlines of a series of smaller leaves were drawn on the template. If a wide range in leaf size was encountered, several templates could be made. The adjustable-platform planimeter method consisted of a portable stand so constructed that a leaf could be placed over a sheet of cellophane attached to it and traced with a planimeter. All three methods were readily adapted to the measurement of attached leaves.

Boynton and Harris (1950) presented data for the estimation of the areas of mature leaves of McIntosh apple, Elberta peach, and Italian prune with the use of the product of leaf length and leaf width. Correlations of McIntosh apple leaf areas with length times width,

length alone, and width alone were found to be extremely high (r = 990, .931, and 964, respectively)

III. EXPERIMENTAL MATERIALS AND METHODS

This research was conducted at the University of Florida Sub-Tropical Experiment Station, Homestead, Florida. The water loss experiments were performed under greenhouse conditions. Leaf area measurements were made on leaves collected from bearing mango budlings in Experimental Block 7 and from pot-grown seedlings in the Experiment Station nursery.

A key to the symbols used in the figures and tables is given in Table 1.

A. Water Loss Experiment--1952

Since a search of the mango literature revealed no indication as to the magnitude of transpiration by pot- or field-grown trees, an exploratory experiment was set up during the latter part of the summer of 1952. The immediate objective was to obtain information on the over-all water losses sustained by young budlings and their seedling checks when the plants were watered at intervals longer than that of normal horticultural procedure.

Plant Materials

Budlings[1]--four Zill variety mango (Mangifera indica L.): veneer-grafted February 19, 1952, on Turpentine variety rootstocks from seeds planted to August, 1951

Seedlings--four Turpentine variety mango (Mangifera indica L.), seeds planted to August, 1951.

The seedlings for observation and for use as rootstocks for the budlings were grown in the Experiment Station nursery in asphalt roofing felt tubes of rich potting soil (approximate composition: one-half Rockdale clay loam, one-fourth sandy muck, one-fourth peat).

About one week before the water loss investigation was begun, the plants were brought into the greenhouse from the nursery hardening area and repotted to two-gallon glazed crocks with as little disturbance of their root systems as possible. Additional potting soil was used as needed to bring the soil level to each crock to about one inch from the rim. At the time of repotting and for several days thereafter, enough water was applied to moisten the soil sufficiently to give drainage from the small side holes at the bottom of the crocks.

The plants were divided into two groups of two seedlings and two budlings each, one set (pots No. 3 and No. 7 seedlings, No. 4 and No. 8 budlings)--designated as "open"--being left open, and the other (pots No. 1 and No. 5 seedlings, No. 2 and No. 6 budlings)--designated

[1]Acquired from a previous experiment conducted by Ibrahim Fahmy.

as "closed"--having vinylite plastic covers over the crocks. The plastic covers for each crock consisted of two layers with their openings staggered at 90°. The inner sheet was held down inside the crock rim by a wire ring and the outer tied securely with twine around the outside of the crock. A divided cork lined with cotton was placed on the plant stem two inches above soil level and held in position by means of a radiator hose clamp to support the covers. All openings except the outside edges of the plastic sheets were sealed with melted beeswax-paraffin grafting wax.

Provision for watering the sealed pots was made by inserting a 0.6 in. diameter glass tube about four inches into the soil about midway between the plant stem and the crock rim. The open pots were watered evenly over the soil surface. Thermometers for soil temperature measurements were similarly sunk in the soil about two inches deep on the side of the crocks opposite the watering tubes in the "closed" pots and at equivalent spots in two of the "open" pots (No. 3 and No. 4). The openings through which the watering tubes and thermometers were inserted to the "closed" pots were sealed to the manner described above.

In order to follow changes in soil moisture during the course of the experiment, pairs of nylon soil moisture resistance blocks (Bouyoucos 1949) were inserted to three of the crocks, No. 1, No. 2,

and No. 3, one block--designated as "bottom"--being set edgewise about one inch above the bottom of the crock and near the center of the soil mass. The other block--designated as "top"--was placed about one inch below the soil surface. Soil moisture samples were not taken.

Initial weights and essentially comparable soil moisture contents were obtained by watering the eight plants sufficiently to give seepage from the small holes at the bottom of the crocks. The pots were permitted to drain for 48 hours before the drain holes were stoppered and the tops of the "closed" crocks were sealed off. All weighings for the experiment were made on Fairbanks scales having a capacity of 20 kg. and sensitivity of 20 gms. per division.

The plants were spaced single file in numerical order at intervals of about double the crock diameter along a north-south center bench and near the south end of the greenhouse. An additional mango seedling not included in the investigation protected the end plant (No. 8) from undue effects of wind from a doorway about ten feet away. Two sets of wet bulb-dry bulb thermometers were suspended at plant height near each end of the row with two recording thermographs underneath them. Air temperatures for the entire greenhouse were read from a thermometer on the north side of a post near the center of the house.

To ascertain the effect of length of watering cycle on water losses, all eight plants were watered at intervals of 28 days, beginning

August 18, 1932, with 250 ml. of nutrient solution[1] plus enough tap water to bring each crock back up to its initial weight. Plants No. 8 through No. 8, inclusive, received supplementary waterings with tap water on the fifteenth day of each cycle. On October 22, 1932, all plants received a micronutrient spray and on November 26, an oil-parathion acaricide.[2] Fungicidal sprays were unnecessary as the plants had received regular semi-monthly applications while they were out of doors. The experiment was terminated December 6, 1932, after the completion of four 28-day watering cycles.[3]

Collection of Data

The data collected during the course of the experiment may be summarized as follows:

(1) Plant weighing, air temperatures,[4] wet bulb temperatures, soil temperatures--three times daily Monday through Friday (approximately 8 A. M., 12 M., and 4 P. M.) and twice on Saturday (4 P. M. weighing, etc., omitted).

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[1] Thirty grams VHPF high analysis soluble fertilizer per gallon of water.

[2] Ninety grams of 98 per cent oil plus 9 gms. parathion to two gallons of water.

[3] From September 1 to December 6, 1932, Mr. Dare Roberts collected the data.

[4] Sheets from thermographs were changed once a week.

(2) Bouyoucos resistance bridge readings for soil moisture--two to three times weekly.

(3) Leaf lengths, leaf widths, number (and condition) of leaves per plant, stem diameter at two inches above soil level, and height--twice monthly.

Conversion of Data

At the conclusion of the experiment, the data were converted from plant weights, etc., to forms more suitable for comparison and analysis. Of the 112 days included in the experiment, three weighings, etc., were made on each of 74 days, two on 17 days, one on one day, and none on 18 days. Water losses between weighings were computed for each plant. Since the number of hours between weighings were not the same during a given day or in some cases on successive days, the water loss values were reduced to grams water loss per hour and grams water loss per hour per 10 dm ^{2} leaf area for three periods of the day, morning (approximately 8 A. M. - 12 M.), afternoon (approximately 12 M. - 4 P. M.), and evening (approximately 4 P. M. - 8 A. M.), and to daily[1] water loss per hour and daily water loss per hour per 10 dm ^{2}

[1] Values for days on which no weighings, etc., were made, Sundays and holidays, were obtained by averaging the figures from one weighing to the next over the 48-hour or 72-hour period as the case might be

leaf area (approximately 8 A. M. - 8 A. M.). The corresponding averages[1] were computed for air temperatures (° C.), wet bulb temperature (° C.), and soil temperature (° C.). The wet bulb temperatures were subtracted from the air temperatures to obtain depression values which were then converted to vapor pressure deficits (mm Hg) by means of standard Weather Bureau psychrometric tables.

The total leaf areas of each plant (Table 2) at the biweekly collection dates were secured by summing the individual leaf areas (cm.^{2}) calculated from leaf lengths with the equation for the composite leaf sample given in Table 28. These values were then plotted against time on a semilogarithmic scale to permit day by day interpolations. Since the plants dropped senescent leaves from time to time, suitable corrections were necessary. If the dates of fall were known, the leaf areas were subtracted from the plant totals for their respective days; if not, they were prorated to whole leaf units at intervals over the two-week period in which the drop occurred. The corrected leaf area values for each day were used for the conversion of water loss per hour to water loss per hour per 15 dm ^{2} leaf area.

Stem areas (cm ^{2}) shown in Table 2, were derived from the corresponding diameters under the assumption that the stems were

[1]Daily averages were computed from the period averages weighted by the number of hours between each collection of data.

circular. Soil moisture resistance readings (ohms) were converted to a logarithmic scale to facilitate plotting.

After the conversions were completed, it was found that data for the morning, afternoon, and evening periods of 72 days and daily values for 1 1/2 days[1] were available for comparison and analysis.

B. Leaf Area Measurements

As spot checks during the summer of 1962 to determine the general relationship between leaf area and leaf length or leaf width of young mango buddings and seedlings showed a high degree of regularity, a series of leaf samples was taken during June and July, 1963. The following collections, all at random, were made:

(1) Leaves from bearing Haden mango buddings in Experimental Block 7

(a) 200 Mature (four lots of 50) from non-current growth flushes.

(b) 100 Juvenile[2] (two lots of 50) from current growth flushes

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[1]Daily averages were computed from the period averages weighted by the number of hours between each collection of data

[2]Red or light green in color.

(2) Leaves from one-year-old Turpentine mango seedlings in nursery tubes

(a) 50 Healthy--from current and non-current growth flushes.

(b) 58 Malformed--from current and non-current growth flushes.

Leaf areas (cm. ^{2}) for the first two lots of mature Haden leaves were obtained by tracing the individual outlines on millimeter cross-section paper and counting the squares. Areas of leaves to the remaining lots were secured by means of planimeter tracings, each measurement recorded being the average of at least three tracings. Leaf lengths (cm.) and widths (cm.) for the Haden lots and leaf lengths alone for the Turpentine lots were recorded at the same time. The data were subjected to regression analysis.

C. Water Loss Experiment--1953

On the basis of the information derived from the 1952 experiment as to the relative magnitude of moisture losses from sealed and open containers, the 1953 water loss experiment was limited to plants in sealed pots but expanded to include the influence of type of graftage, age of plant, and six environmental factors.

Plant Materials

Scions--Haden variety mango (Mangifera indica L.)

Rootstocks (and seedling checks)--Turpentine variety mango from seeds planted July, 1952

Table 5 shows the types of graftage,[1] dates of grafting, and number of plants included in the 1953 water loss experiment. The scions were obtained from young vigorous bearing trees. The rootstocks and seedling checks were grown in the Experiment Station nursery in asphalt roofing felt tubes and No. 10 cans of nursery potting soil.

Except for differences in the height of the unions, approximately 15 cm. above soil level, and the extent to which the rootstocks were cut back after the scions had sprouted,[2] 15 to 20 cm. above the union, the usual nursery practices with regard to propagation and after-care of the buddings were followed. In spite of semi-monthly fungicidal sprayings as a part of the nursery maintenance program, the leaves on the seedlings and a few of the buddings were malformed as a result of infection by anthracnose (Colletotrichum gloeosporioides) and mango scab (Elsinoe mangiferae).

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[1] Mr. Roy Nelson, Superintendent, University of Miami Experimental Farm, Richmond, Florida, propagated the buddings.

[2] The abnormally long rootstock stubs protected the scion shoots from breakage during handling.

Experimental Procedure

Preliminary operations. --About ten days before the water loss test period, the plants were brought into the greenhouse and carefully repotted into sound No. 10 cans. After the plants were given a thorough soaking to prevent the soil from crumbling, the bottoms of the cans were removed with a crank-driven can opener. Double thicknesses of unbleached muslin cut into ten inch squares were then slipped under the cans and fastened into place with rubber bands. The plants were set on a bench in the greenhouse and separated into six blocks containing 18, 18, 14, 14, 18, and 12 treatments, respectively. The blocks and treatments were randomized according to a pattern previously worked out with playing cards. In order to minimize differences in exposure to light and wind, the blocks were oriented north and south along the center bench of the greenhouse. Two sets of three parallel rows were placed on either side. The space between rows was about eight inches and between sets about two feet, the latter space being reserved for instruments. Later, this arrangement was found to be too crowded for easy manipulation. Preliminary determinations for number of leaves, leaf lengths (cm.), stem diameters (cm.), and heights (cm.) were made on each plant at this time.

Twelve thermocouples, consisting of 22 ga. copper-constantan glass-insulated wires about three feet long with oxygen-gas fused

junctions (borax flux), were inserted at depths midway between the top and bottom of the soil and as close to the tap root as practicable in each of 12 containers, two per block, for the measurement of soil temperatures. A similar number of thermocouples of 30 ga. copper-constantan glass-insulated wires about five feet long with oxygen-gas fused junctions (borax flux) were threaded through wall exposed leaves on the same plants for leaf temperature measurements. The junctions were pushed through the leaf blades from below at a point near the center of the leaf lengthwise in close proximity to the midrib and held in position by means of grafting wax applied above and below. The wires were led down along the stems, small lumps of wax being used to hold them in place on the upper parts and rubber bands on the lower. Figure 1 shows the leaf and soil thermocouples in place together with the Leeds and Northrup thermocouple potentiometer used for measuring temperatures. The thermocouples were placed in as many different treatments as possible and the individuals carrying them spaced out within each block so as to provide a representative distribution over the test area.

Tension table. --Soil moisture samples were not taken. A soil moisture tension table (Leamer and Shaw 1941) having a water column height of 60 cm.[1] (an effective water table 60 cm. below the

[1]A soil moisture tension measured as 60 to 100 cm. of water is regarded as the upper limit of the field capacity range (Richards and Wadleigh, 1952).

Fig. 1.--View of Haden mango budling and Leeds and Northrup thermocouple potentiometer showing arrangement for measuring leaf and soil temperatures. (Soil thermocouple wires are connected to the instrument.) Note condensed moisture on inside of bag.

working surface) was constructed on the greenhouse bench, however, to ensure that all of the containers would have the same relative moisture content.

The tension table consisted of a 36 by 36 in. square sheet of 16 ga. galvanized steel with a 3/16 in. hole drilled to the center. A series of four steel angle irons was placed on top of the boards of the greenhouse bench for support. A short length of 1/4 in. copper tubing soldered to the underside of the table in line with the hole in the sheet, a Tygon tubing sleeve, and a piece of 1/4 in. glass tubing with an "S" bend at the lower end and just long enough to clear the ground by two to three inches completed the column proper. The upper portion of the tension table consisted of a 32 by 32 in. square of galvanized window screening and an absorbing surface of 1/2 in. thick asbestos sheeting cut so as to overlap the screen wire by at least three inches on all sides. Both layers were carefully laid; the asbestos sheet was sealed around the edges with automobile window sealer compound so as to prevent the entrance of air bubbles. An open-bottomed wood frame box 36 by 36 by 36 in. with three stationary sides and top of wall board and one side removable, covered with plastic cold-frame cloth, was placed over the tension table in order to keep down evaporation losses. As constructed, the tension table would hold 25 plants without undue crowding.

The procedure for operating the tension table consisted of flooding the surface with water and applying gentle suction to the water column tube with a water aspirator until all air bubbles were removed from the system. The excess water was allowed to drain away and, provided the column remained unbroken after a half hour or more with the box door closed and sealed with damp cloths, the table was ready for use. If the water column broke within the period mentioned, the leak was found and plugged with sealer compound. Shortly before they were to be put on the tension table, the plants were plunged up to the can rims to a tub of water until the soil was saturated. They were then set in place and the inside of the box sprayed with a fine stream of water to reduce evaporation. The box door was closed and sealed around the edges with damp cloths. The water column was inspected from time to time to be sure it had not broken during the 30 to 48 hours[1] which the plants remained on the tension table. Insofar as possible complete blocks of plants were set on the table together so that any differences between successive runs would be manifested between blocks and not among treatments to a given replication. Tension table operations were

[1]Thirty to 48 hours were regarded as being a sufficient length of time to permit the soil moisture in the containers to come to equilibrium with the 60 cm. tension used.

egun August 5, 1953, and were completed for all six blocks by August 15.

Procedure for sealing pots. --Immediately upon their removal rom the tension table, the containers were placed in individual 8 by 4 y 12 in. polyethylene freezer bags.[1] The tops of the bags were tied s low and as tightly as possible around the plant stems with large ubber bands. Soil thermocouple wires for the 12 plants carrying them were run up along the stems and out through the open end of the bags. nce the containers were sealed, they were not reopened except for atering or when the continual abrasion on the wood bench wore holes n the bottom of the bags so that they had to be replaced. As soon as it as bagged, each plant was weighed on the same set of scales used the revious year, all subsequent operations being based on this initial eight.

Experimental arrangement and instrumentation. --Figure 2 hows the experimental arrangement of the plants and instruments on e greenhouse bench. Six field crates approximately 16 in. high were id in three rows of two each in an open spot on the ground inside the reenhouse far enough away from the bench so as not to be shaded. hree blocks of plants could be accomodated on the boxes and two double

[1]Polyethylene plastic is moisture proof but has pores large nough to permit the interchange of gases.

Fig. 3. --General view of 1953 water loss experiment. The tension table is at the left, the anemometer and hygrothermograph in the center, and the scales and thermocouple potentiometer at the right. Three blocks of plants are on the greenhouse bench, the remaining three being on boxes parallel in the bench and out of the picture.

rows on either side of the bench without crowding, one block location always being left vacant. During the entire water loss last period, each block was set in a different spot after each weighing than the one it had previously occupied. All blocks were systematically shifted around so that each of them was subjected in essentially the same degree to the differences in exposure to light, air currents, and temperature which existed in the greenhouse. A hygrothermograph for air temperature and relative humidity records was set on a box about midway between the two double rows of plants on the bench. A portable fan-type integrating anemometer was mounted on a tripod about 18 in. high over the double row on the side of the bench directly opposite the greenhouse door. The scales and the Leeds and Northrup automatic temperature compensation thermocouple potentiometer were located at the south end of the blocks on the bench. A pair of wet bulb-dry bulb thermometers were suspended at plant height near the center of the rows.

Watering schedule.--The plants were watered at intervals of four to five days just after the afternoon weighings from the time they were taken off the tension table until August 18. After this date, they were watered according to the following schedule:

(1) August 19--All blocks[1]

[1] Twenty ml. of a 5 per cent solution containing ammonium nitrate and Chatelier's complete plant food (8-8-20) in the proportions 25:75 was given each plant.

(k) August 23--Blocks 1, 2, 3
August 24--Blocks 4, 5, 6

(l) August 27--Blocks 1, 2, 3
August 28--Blocks 4, 5, 6

(m) September 2--All blocks

The procedure for watering was to set the plant on the scales, record the weight, loosen the rubber band from around the stem, pour sufficient tap water over the surface to bring the weight up to its initial or corrected[1] value, and retighten the rubber band.

Collection of Data

Beginning on August 15, 1955, the day the first group of plants was removed from the tension table, the following data were collected:

(1) Three times daily (starting times approximately 7:30 A.M., 11:30 A.M., and 3:30 P.M.[2])--soil and leaf temperatures (12 each), wet bulb-dry bulb temperatures, air temperature and relative humidity (from hygrothermograph), wind movement since the previous weighing, light intensity (portable light meter), and individual plant

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[1] Additional weight of a new plastic bag or muslin bottom cover plus the initial value.

[2] Sixty to 55 min. were required to complete a data collection.

weights.[1]

(2) Once weekly--individual leaf lengths (cm.), stem diameter (cm.), height (cm.), and number of leaves for each plant; hygrothermograph chart changed.

The experiment was terminated September 5, 1953.

Conversion of Data

Losses in plant weights between successive weighings were reduced to water loss per hour (gms.) for three periods of the day, morning (8 A. M. - 12 P. M.), afternoon (12 M. - 4 P. M.), and evening (4 P. M. - 8 A. M.), and daily water loss per hour (gms., 8 A. M. - 8 A. M.). Corresponding averages for the three periods of the day were obtained for air temperature (° C., from hygrothermograph readings), vapor pressure deficit (mm. Hg, calculated from hygrothermograph relative humidity readings and wet bulb-dry bulb temperatures by means of standard Weather Bureau psychrometric tables), wind movement (10 cu. m. per hour), light intensity (lumens per cm.^{2}), soil temperature (° C.), and leaf temperature (° C.). The total leaf area (cm.^{2}) per plant (Table 4) for each of the weekly data collection dates was derived from the summation of the individual leaf areas calculated from leaf

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[1] The data were recorded in the order given; four data collections were made daily for the period Aug. 15 through Aug. 20, inclusive, but were reduced to a three times daily schedule for purposes of analysis.

lengths with the use of equations d and 8 given in Table 28. The resulting figures were plotted against time on semilogarithmic paper so that the leaf area values for each day of the experiment could be obtained directly. Corrections for leaves which had fallen off between collection dates were prorated leaf by leaf[1] if the actual date of droppage was unknown. Stock[2] stem areas (cm. ^{2}) were derived from the corresponding diameters, under the assumption that the trunks were circular in cross section.

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[1]In cases where a dropped leaf could not be found, the area of the oldest leaf on the plant was subtracted as a unit.

[2]Stem diameters were measured on the stock at the height of the middle of the union zone for the buddings and at 18 cm. above ground level for the seedling checks.

IV. RESULTS AND DISCUSSION

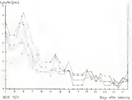
A. Water Loss Experiment--1952

Rate of Water Loss

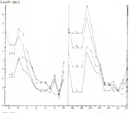
Daily rates per hour.--In conformity with previous reports for a number of species by Briggs and Shantz (1916a, b; 1917), Kiesselbach (1916), and other workers, the rate of water loss from young mango trees showed wide variations from day to day and from plant to plant. These points are well illustrated in Figures 3 to 7 and Tables 5 and 6 for daily water loss per hour (gms.) over four 28-day cycles in 1952 and their average. It may be noted that for the first six or eight days after the plants were watered the rates ranged from 1.98 to 6.46 gm./hr. for the seedling and from 1.28 to 5.42 gm./hr. for the budling in "closed" containers watered at 28-day intervals. The rates of plants in "open" containers varied from 1.88 to 8.12 gm./hr. for the seedling and from 2.38 to 8.33 gm./hr. for the budling. The corresponding values for plants watered at 14-day intervals were 1.52 to 5.88 gm./hr. for the seedling and .73 to 7.29 gm./hr. for the budling in "closed" containers; in "open" containers, the rates varied from 2.92 to 18.96 gm./hr. for the seedling and from 2.62 to 18.61 gm./hr. for the budling.

The general pattern of daily water loss rates for the four plants

Fig. 3.--Daily water loss per hour (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of August 15 to September 11, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)

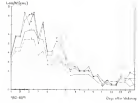


8/15 9/11



8/15 9/11

Fig. 4.--Daily water loss per hour (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of September 12 to October 9, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)


Loss/hr (gms.)
9/12-10/19
Days after Watering

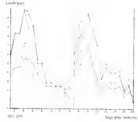
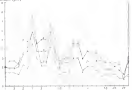
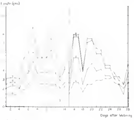

Loss/hr (gms.)
9/12 10/9
Days after Watering

Fig. 5.--Daily water loss per hour (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of October 10 to November 6, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)

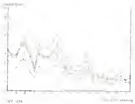


10/10 11/6



0/10 11/6

Fig. 6.--Daily water loss per hour (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of November 7 to December 4, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open" 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)


3
5
7
11/7 12/4
Watering

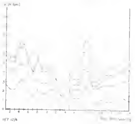
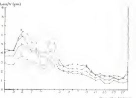
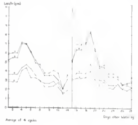

0
1
2
3
2
4
6
8
11/7 12/6

Fig. 7.--Daily water loss per hour (gms.) of Zill mango buddings and Turpentine seedlings grown in closed and open containers for the average of four watering cycles in 1953. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)


Loss/hr (gms)
Average of 4 Cycles
Days after Watering


Loss/hr (gms)
Average of 4 cycles
Days after Watering

watered at intervals of 28 days (Figures 3 to 7, top and Table 5) was rather uniform from cycle to cycle. In the first cycle, August 15-September 11, the rates of all four plants were high the first day, somewhat lower the second and third, higher on the fourth, and then gradually tapered off to the twenty-eighth day with minor increases and decreases along the way. In the second cycle, September 12-October 9, the rates gradually increased from an initial level about half that of the first cycle up to a maximum on the fourth to sixth days, after which they decreased. The rates of the third cycle, October 10-November 6, resembled those of the first except that the maximum did not occur until the seventh day. The rates of the fourth cycle, November 7-December 4, were similar to those of the second cycle except that maximum rates were somewhat lower, occurred on the fourth and fifth days after watering, and were also more variable over the entire cycle. When the average of four cycles were considered, the rates for each plant exhibited maxima on the fourth or fifth and on the eleventh or twelfth days after watering, the second peak being somewhat lower than the first. The days after watering on which the minimum rate occurred for any given plant varied from the twenty-third to the twenty-sixth. Moderate increases in rates at the very end of the cycle were observed for both seedlings and the "open" budling.

The two right-hand columns in Table 5 show the differences

in rates between pairs of plants, "open" and "closed" seedlings and buddings. These data are of interest mainly to illustrate the decided variability in the performance of pairs of plants from day to day, as evidenced by the numerous minus values. In general, however, the difference between the rates of the seedlings was smaller on a given day than that between the rates of the buddings, except after about the nineteenth or twentieth day in the third and fourth cycles. As may be seen from the slopes of the curves in Figures 3 to 7, top, the bulk of the variation, and hence of the differences, between seedlings or buddings can be attributed to the "open" member of each pair.

The values of daily water loss per hour for the four plants watered at intervals of 14 days (Figures 3 to 7, bottom, and Table 6), exhibited certain marked differences from those of the plants watered at 28-day intervals. With few exceptions, the former had much higher initial and maximum rates of loss. A comparison of the rates during the 14 days after watering for the 28-day cycle plants and the "a" cycles for the 14-day plants showed that the latter were losing water somewhat faster in most cases. Furthermore, the day-to-day variations in rate were usually greater for the 14-day cycle plants. Somewhat less regularity was observed in the number of days after watering before the 14-day cycle plants reached their maximum rate of water loss.

The differences in rates of 14-day cycle seedlings and buddings, given in the right-hand columns of Table 6, showed wide variation although fewer negative values were obtained than with the 28-day plants. Unlike the latter, however, the difference between the rates of the 14-day seedlings was as likely to be larger as smaller on a given day than that between the rates of the 14-day buddings.

Certain generalized inferences may be drawn from the data on daily water loss per hour presented thus far. Under the conditions of the experiment, the "closed" seedlings of both the 28-day and 14-day watering cycle groups were usually found to have somewhat lower rates of water loss than the "closed" buddings. On the other hand, the "open" seedlings were generally observed to have somewhat higher rates of water loss than the "open" buddings. The rates of the 14-day cycle plants were generally higher than those of the 28-day plants for the corresponding portion of their cycles. The difference in rates between the "open" and the "closed" pairs was noted to be lower, with many more negative values, for the 28-day plants, an indication of greater plant variability. Roughly 25 to 50 per cent of the water loss from the "open" plants appeared to be the result of evaporation. The lag period in the two sets after the plants were watered and before the water loss rates reached a maximum appeared to be a function of the soil moisture stress attained in the preceding cycle, since the 14-day

cycle plants required one or two days less to attain a maximum rate in many instances.

Daily rates per hour per unit leaf area.--When plant size differences were removed by converting the daily water losses per hour to daily water loss per hour per 10 dm.^{2} leaf area, the figures presented a quite different aspect. As shown to Figures 9 to 12 and Tables 7 and 8, the rates were much reduced and their ranges correspondingly restricted. For example, the "open" seedling of the 28-day watering cycle group had rates varying from 1.49 to 6.71 gm./hr./10 dm.^{2} leaf area during the first six to eight days after watering, while those of the corresponding "closed" seedling ranged from 1.02 to 3.45 gm./hr./10 dm.^{2} leaf area. While the rate curves on a leaf-area basis for each plant of both the 28-day and 14-day watering cycle groups were flatter than their per-plant counterparts, the position of the maxima and minima were unchanged.

The chief contrast between the two sets of data lay in the effect on the difference between the "open" and "closed" plant pairs produced by removing plant size variations. For the 28-day cycle pairs, the seedlings showed larger differences from day to day with fewer negative values than the budlings, the values for the latter being negative about 60 per cent of the time. The seedling pair again exhibited larger differences from day to day in the 14-day cycle group than the budlings,

Fig. 8.--Daily water loss per hour per 16 dm.^{2} leaf area (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of August 15 to September 11, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)

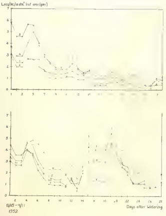
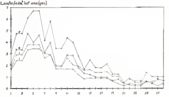
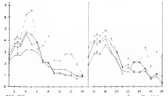

Loss/hr./sq dm² leaf area (gm)
Days after Watering
8/15 - 9/11
1952

Fig. 9.--Daily water loss per hour per 15 dm.^{2} leaf area (gms.) of Zill mango buddings and Turpentine seedlings grown in closed and open containers for the watering cycle of September 12 to October 9, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)





9/12-10/11
1952

Fig. 10.--Daily water loss per hour per 10 cm.^{2} leaf area (gms.) of Zill mango budlings and Turpentine seedlings grown to closed and open containers for the watering cycle of October 9 to November 6, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)

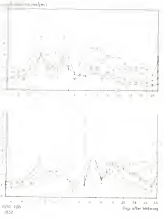

10/10 11/6
1952
Days after Watering

Fig. 11.--Daily water loss per hour per 10 dm.^{2} leaf area (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the watering cycle of November 7 to December 4, 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)

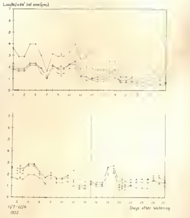
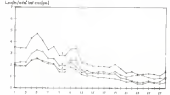
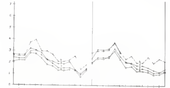

Loss/hr./10 dm² leaf area (gms.)
11/7 - 12/4
1952
Days after Watering

Fig. 12.--Daily water loss per hour per 10 $dm.^2$ leaf area (gms.) of Zill mango budlings and Turpentine seedlings grown in closed and open containers for the average of four watering cycles in 1952. (1 - seedling "closed", 2 - budling "closed", 3 - seedling "open", 4 - budling "open", 5 - seedling "closed", 6 - budling "closed", 7 - seedling "open", 8 - budling "open".)





Average of 4 Cycles
1952

Days after Watering

and roughly 28 per cent of the values were negative. The budling pair, on the other hand, had negative values on 101, and zero difference on two, out of 112 days.

It is manifestly impossible for a plant in an open container to lose water by transpiration from its leaves and not lose water by evaporation from the soil; thus, the only logical interpretation of these data is that the plants used in this experiment had a wide variation in their rates of water loss per unit leaf area. Further inferences are unwarranted since, as to the case of the budlings of the 14-day watering cycle group, either the "open" budling may have had a rather low rate or the "closed" budling a rather high rate of water loss per unit area. Alternatively, both conditions might have existed.

Rates per hour for three periods during the day. --Water loss per hour data were available for the morning, afternoon, and evening periods of 73 days. As the data showed a much wider day-to-day range among the eight plants within a given period than daily water loss per hour values, they were averaged. The data are presented graphically to Figures 17, 18, and 19 and numerically in the left hand data columns of Tables 11, 12, and 13. The average rates of water loss per hour were usually higher to the afternoon period than in the morning, while those of the evening were far smaller than either of the other two. For example, the morning rate of loss on September 17

was 19.06 gm./hr., the afternoon, 23.96, and the evening, 1.07. About 40 per cent of the water loss during the day occurred in the morning, 91 per cent in the afternoon, and 9 per cent in the evening. On November 25, the morning rate of loss was 15.50 gm./hr., the afternoon, 10.42, and the evening, 0.33. About 56 per cent of the water loss during the day occurred in the morning, 39 per cent in the afternoon, and 5 per cent in the evening. While the exact values varied from day to day, the water losses during the evening period rarely exceeded 10 per cent of the daily totals.

The rates for each period showed the same pattern during the course of the watering cycles as the daily water loss per hour rates, although they were masked somewhat by the wide day-to-day range.

Effects of Environmental Factors on Rates of Water Loss

Effects of environmental factors on rates of daily water loss per hour. --The average daily values for air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) during the four 20-day watering cycles are given to Figures 13 and 14 and Table 9. When curves of the environmental factors are compared with those for daily water loss per hour (on either a per-plant or unit-leaf-area basis), it is noted that shifts in water loss rate maxima and minima from cycle to cycle may be traced for the most part to corresponding changes to vapor pressure deficit and air temperature. The curves for

Fig. 13.--Daily average air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) for watering cycles of August 15 to September 11, September 12 to October 9, and October 10 to November 6, 1932.

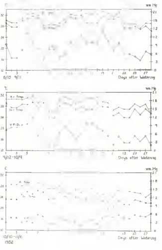
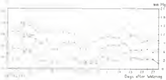
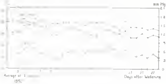

mm Hg
8/15 - 9/11
Days after Watering
°C
mm Hg
Air Temp.
Soil Temp.
V.P.D.
9/12 - 10/9
Days after Watering
°C
mm Hg
Air Temp.
10/10 - 11/6
1952
Days after Watering

Fig. 14.--Daily average air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) for watering cycle of November 7 to December 4, and average of four watering cycles in 1952.


mm Hg
Days after Watering


mm Hg
Average of
1956
Days after Watering

soil temperature generally followed those for air temperature, but on certain occasions they differed markedly--as, for example, on the eighth to eleventh days after watering in the first cycle and from the fifteenth to seventeenth days in the fourth cycle--and produced corresponding changes in the water loss curves.

As shown in Figures 15 and 16 and Table 10, the top soil moisture resistances (ohms) of the two "closed" containers of the 28-day watering cycle group (plants No. 1 and No. 2) usually increased at a somewhat slower rate than those of the "open" plant (No. 3). Apparently, soil moisture was being depleted most rapidly from the "open" container (No. 3) and least rapidly from the "closed" crock in which the budling was grown (No. 2). If the approximate soil moisture resistance values listed by Bouyoucos (1949) for field capacity, 2500 ohms, and permanent wilting point,[1] 300,000 ohms, of moderately heavy soils are converted to their logarithmic values, 3.398 and 5.477, respectively, and applied to these data, the soil moisture of the "open" container (No. 3), as measured by the "B" block, reached field capacity between the second and eleventh day after watering in the first cycle, between the eighth and the eleventh in the second cycle, between the eighteenth and twentieth in the third cycle, and on the fifteenth to the

[1]Full discussions of field capacity and permanent wilting point are given by Richards and Wadleigh (1952).

Fig. 15.--Log soil moisture resistance (ohms) of pairs of nylon soil moisture resistance blocks inserted in containers holding a Zill mango budling or a Turpentine seedling, for the watering cycles of August 15 to September 11 and September 12 to October 9, 1952. (1 - seedling in "closed" container, 2 - budling in "closed" container, 3 - seedling in "open" container; B - block located 1 inch above bottom of container, T - block located 1 inch below soil surface.)

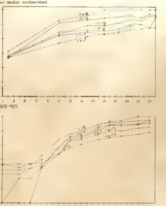
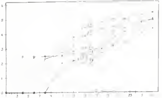
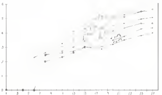

log Soil moisture resistance (ohms)
6
5
4
3
2
1
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27
8/15-9/11
6
5
4
3
2
1
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27
9/12-10/9
1952
Days after Watering

Fig. 17.--Average water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) for the morning period of 73 days in 1952. (Boundaries of watering cycles are marked by dashed vertical lines.)

log Soil moisture resistance(ohms)



10/10-11/6



11/7-12/4
1952

Days after Watering

fourth cycle. The permanent wilting point was reached between the eleventh and sixteenth day after watering in the first cycle, between the eighteenth and twentieth in the second cycle, on the twenty-seventh in the third cycle, and between the twenty-fifth and twenty-seventh in the fourth cycle. The soil moisture of the "closed" container in which the seedling was grown (No. 1) reached field capacity between the second and eleventh day after watering in the first cycle, between the eighth and eleventh in the second cycle, between the thirteenth and sixteenth in the third cycle, and between the eleventh and thirteenth in the fourth cycle. The permanent wilting point was not attained at any time. The "closed" container (No. 2) in which the budling was grown reached field capacity between the eleventh and sixteenth day after watering in the first cycle, between the thirteenth and fifteenth in the second cycle, between the twenty-second and twenty-fifth in the third cycle, and between the twenty-fifth and twenty-seventh in the fourth cycle. The permanent wilting point was not reached.

The log soil moisture resistances of the top blocks (marked T in the graphs) followed roughly the same pattern as the bottom blocks but, as may be noted in the figures, they were decidedly more erratic in their performance from cycle to cycle. This resulted in part from their location with respect to the main root masses, since the bottom blocks were completely surrounded with roots whereas the top blocks

had comparatively few roots around them. The continual loss of moisture from the soil to the closed or open atmospheres was doubtless also a contributory factor. In the case of the "closed" containers soil moisture was constantly being evaporated and subsequently being condensed on the plastic covers. The water thus removed was not lost to the plants but dripped back on the soil around the edges of the containers, thus in effect redistributing the moisture to the detriment of the central portion of the upper quarter of the soil mass where the "top" resistance blocks were located. The "open" crock (No. 3), on the other hand, lost soil moisture directly to the air.

If it is assumed that the 14-day watering cycle plants depleted the soil moisture of their respective containers in field capacity or to the permanent wilting point to a number of days equivalent to the performance of the 28-day plants, the higher rates of water loss in each cycle, like the shorter lag periods before maximum rates of water loss were attained, appeared to be a function of the soil moisture stress reached in the preceding cycle. Outward evidence as to the effect of soil moisture stress was lacking since none of the plants wilted during the course of the experiment[1] and six of the eight put on new fall flushes

[1]The plants were re-watered on December 5, 1952, at the end of the fourth cycle and then were permitted to go without further additions until they died. On February 6, 1953, two full months later, the "open" plants were showing severe drought symptoms, as evidenced by their shriveled stems, parched, leathery leaves, and partial defoliation, while the "closed" individuals appeared to be normal in every respect.

of growth in September and October.

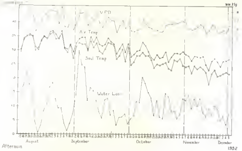
Effect of environmental factors on rates of water loss at different times of the day.--Average water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) values are presented in Figures 17, 18, and 19 and Tables 11, 12, and 13 for the morning, afternoon, and evening periods of 73 days during 1952. Since visual examination of the curves for average rate of water loss and the environmental factors showed many apparent discrepancies, the data were subjected to regression analysis.

The regression analyses for the three periods of the day taken separately and the totals of the three periods of the day taken separately ("within periods") are given in Table 14. The total (multiple) correlation coefficients, expressing the relationships between average water loss per hour and air temperature, vapor pressure deficit, and soil temperature, of the four sets were all far larger than could be explained on the basis of sampling variation. The partial correlation coefficients, expressing the relationships between average water loss per hour and one environmental factor while holding the other two constant, for soil temperature in the morning, vapor pressure deficit in the evening, and soil temperature in the "within periods" were all significantly larger than sampling variation. The partial correlation coefficient for vapor pressure deficit in "within periods" was much larger than could be

Fig. 16.--Log soil moisture resistance (ohms) of pairs of nylon soil moisture resistance blocks inserted in containers holding one Zill mango budling and two Turpentine seedlings, for the watering cycles of October 10 to November 6 and November 7 to December 4, 1952. (1 - seedling in "closed" container, 2 - budling in "closed" container, 3 - seedling in "open" container; B - block located 1 inch above bottom of container, T- block located 1 inch below soil surface.)

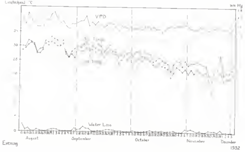

mm Hg
October

Fig. 18. --Average water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) for the afternoon period of 73 days in 1952. (Boundaries of watering cycles are marked by dashed vertical lines.)



mm Hg
V.P.D.
Air Temp
Soil Temp
Water Loss
40
35
30
25
20
15
10
5
0
August
September
October
November
December
Afternoon
1932

Fig. 19.--Average water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), and soil temperature (° C.) for the evening period of 73 days in 1952. (Boundaries of watering cycles are marked by dashed vertical lines.)


Loss/hr./gm. °C
mm Hg
VPD
Water Loss
August
September
October
November
December
1952
Evening

accounted for by sampling variation. With two exceptions, the simple correlation coefficients, expressing the relationships between average water loss per hour and each of the environmental factors separately, were likewise highly significant. The evening soil temperature comparison was non-significant while the morning soil temperature comparison was significant.

With the exceptions noted, the foregoing statements imply that the three environmental factors, individually and collectively, had a definite bearing on the magnitude of water loss rates for any period of the day or for the periods taken as units and lumped together. The size of the correlation coefficients within any given group in Table 14, in either a horizontal (period to period) or vertical (factor to factor) direction, indicates which factor had the greatest influence on the water loss rates. For example, air temperature accounted for a greater proportion of the evening water loss rates than either vapor pressure deficit or soil temperature when the environmental factors were compared singly. However, if air temperature and soil temperature were held constant, vapor pressure deficit had the largest influence on rates. Vapor pressure deficit had a greater influence on both the morning and the afternoon rates than either air or soil temperature, when the factors (and periods) were considered separately, and played a somewhat larger role in determining the afternoon rates than those of the morning period.

When the effects of the environmental factors were compared as a unit, they accounted for a larger proportion of the rates in the afternoon than in either the morning or evening.

The data in Table 14 are informative, but they do not give any indication as to whether or not a given environmental factor had an appreciable influence on the differences in water loss rates of the three periods. Two sets of analyses were run, tests of significance for the partial regression coefficients comparing pairs of periods and analyses of covariance for the individual environmental factors.

The tests of significance for the partial regression coefficients comparing pairs of periods are shown in Table 15. The figures reveal that the regression of water loss rates on soil temperature, while holding air temperature and vapor pressure deficit constant, had a highly significant influence on the comparative rates of water loss of the morning and evening periods. The variations in water loss rates of the morning and evening periods were thus affected by changes in soil temperature, when the other two factors were held constant, to such an extent that the chances of their being the result of sampling error were less than one in 100. Similarly, the odds were somewhat less than one in 20 that the regressions of water loss rates on soil temperature, while holding air temperature and vapor pressure deficit constant, for the afternoon and evening periods and of water loss rates on vapor pressure deficit,

while holding air and soil temperature constant, for the afternoon and evening periods were the result of sampling variation. All of the other comparisons showed that sampling variations were great enough to obscure any effects which might have been present.

The analyses of covariance for rates of water loss and the individual environmental factors are presented in Tables 16, 17, and 18, for air temperature, vapor pressure deficit, and soil temperature, respectively. Each analysis consists of three parts: (a) the comparison of mean rates of water loss for the morning, afternoon, and evening periods after the rates have been adjusted to a common level of the given factor, (b) the proportion of the unexplained variability of the unadjusted period means removed by the analysis; and (c) a comparison of rates of water loss adjusted to a common level of the given factor within each of the three periods. The calculations for air temperature, Table 16 A, permit the conclusion that the adjusted mean rates of water loss for each period were sufficiently different as to practically eliminate the possibility of chance variation. In the absence of an analysis of variance, this test showed that the rates of water loss for the three periods differed by highly significant amounts, thus bearing out the visual impression given by the water loss data to Tables 11, 12, and 13. Table 16 B indicates that the analysis of covariance removed a large proportion of the unexplained variability of the (unadjusted) mean rates

of water loss. The figures in Table 16 C show that the effect of air temperature on rates of water loss was not the same during the morning, afternoon, and evening periods.

It is obvious from these observations and the evidence presented in Table 16 B that air temperature alone did not exert a controlling influence on rates of water loss, but that other environmental factors, measured and unmeasured, also played a substantial role. Similar conclusions may be drawn for vapor pressure deficit and soil temperature, Tables 17 and 18, respectively.

The effects of the three environmental factors on rates of water loss at different times of day may be summarized by saying that air temperature, vapor pressure deficit, and soil temperature all had a profound influence whether they were examined individually or collectively. When one factor was varied while the other two were held constant, the effect was negligible except in a few instances. The individual factors were found to affect the magnitude of rates of water loss during the morning, afternoon, and evening periods after the rates were adjusted to a common level for each factor, but no one of them exerted a controlling influence. The effect of a given environmental factor on rates of water loss varied from period to period, indicating that other factors which had not been measured were contributing to a greater or lesser degree.

B. Leaf Area Measurements

With the exception of the malformed leaves collected from young Turpentine seedlings, all of the samples, whether from Haden or Turpentine trees, showed a remarkable constancy in leaf shape. Few leaves were disproportionately long for their width or unusually wide for their length, in spite of broad ranges in both categories, if they were uninjured. Leaves malformed by reason of disease infection, wind, insect depredations, mechanical injury, and the like were found to be of every conceivable size and shape; yet they too showed a sufficient degree of regularity to warrant a mathematical study of the relationship between leaf area and length.

The leaf measurements for 200 mature Haden leaves are given in Table 19, for 100 juvenile Haden leaves in Table 21, for 50 healthy (uninjured) Turpentine leaves in Table 25, and for 50 malformed Turpentine leaves in Table 26. The data were analyzed in two ways: First, multiple regressions were run on the mature Haden and juvenile Haden samples to compare the linear relationships of leaf area, length, and width. Second, curvilinear regressions were run on 50 leaves of each of the four samples and on a composite sample of 100 leaves, 50 from each of the two Haden and the healthy Turpentine groups, to compare the logarithmic relationship of leaf area and leaf length.

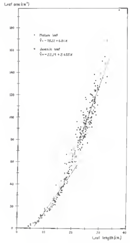
As shown in Tables 20 and 22 for mature and juvenile Haden

leaves, respectively, the relationships between leaf area, length, and width, between leaf area and length while holding width constant or vice versa, between leaf area and length, and between leaf area and width were all far larger than could be accounted for on the basis of variations in sampling.

The simple correlation coefficients have particular interest since they infer that leaf area may be estimated from either length or width with a probable accuracy of at least 80 per cent for both sets of leaves separately. The areas of a mixed sample including both mature and juvenile Haden leaves cannot be estimated from leaf lengths on a linear basis, however, as illustrated by Figure 20, since the relationship is definitely curvilinear.

The leaf areas and lengths of 50 leaves each from the two Haden samples analyzed previously plus two lots of the same size of healthy Turpentine and malformed Turpentine specimens were converted to logarithmic form as given in Tables 23, 24, 25, and 26. The data for each set were then reanalyzed. When the results showed that at least 88 in 93 per cent of the existing variation could be accounted for, the three samples of uninjured leaves were combined (Table 27). As the figures in Table 28 indicate, leaf areas of uninjured leaves may be estimated from leaf lengths, via a logarithmic transformation, with a probable accuracy of at least 95 per cent, provided the equation for the

Fig. 20. --Leaf areas (cm.^{2}) and leaf lengths (cm.) of 200 mature and 100 juvenile leaves from seven-year-old Haden mango budlings.


Leaf area (cm²)
• Mature leaf
Ŷ = −38.22 + 6.81 X
× Juvenile leaf
Ŷ = −22.19 + 3.635 X
0
20
40
60
80
100
120
140
160
180
10
20
30
40
Leaf length (cm.)

composite sample is used. Similarly, the areas of malformed leaves may be estimated with a probable accuracy of about 90 per cent by means of the equation for malformed leaves. The very high degree of correlation in the two sets may be seen in Figures 21 and 22, portraying the composite sample and malformed Turpentine leaves respectively.

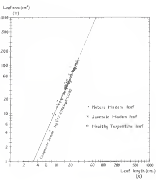
C. Water Loss Experiment--1953

The observations made during the course of the 1953 experiment were divided for study purposes into two partially overlapping groups. Water loss data for 12 of the 19 days between August 13 and September 5, 1953, on which three measurements daily were available, were selected for detailed examination of treatment effects. Mean water loss values of 64 plants and averages of environmental factor readings on 19 days were utilized for comparing the influence of six environmental factors on water loss. All calculations and comparisons were made on the hourly rates or averages.

Water loss data for 12 days were reduced for analysis by combining them into groups[1] based on three days after watering and on three weighing periods a day. The resulting analysis designs were a split-plot for daily water loss per hour with dates and types of graftage as

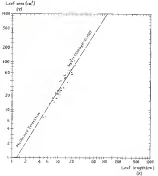
[1]The data were analyzed as the sum of rates for four watering periods.

Fig. 21. --Leaf areas ($cm.^2$) and leaf lengths (cm.) of a composite leaf sample containing 50 mature leaves from seven-year-old Haden mango budlings, 50 juvenile leaves from seven-year-old Haden budlings and 50 healthy leaves from one-year-old Turpentine seedlings.



Leaf area (cm²)
(Y)
Composite Sample
• Mature Haden leaf
× Juvenile Haden leaf
○ Healthy Turpentine leaf
Leaf length (cm.)
(X)

Fig. 22.--Leaf areas (cm.^{2}) and leaf lengths (cm.) of 50 malformed leaves from one-year-old Turpentine mango seedlings.


Leaf area (cm²)
(Y)
1000
500
200
100
60
20
10
6
4
2
1
Malformed Turpentine
log Ŷ=1.5508 logX−0.1727
1
2
4
6
10
20
60
100
200
500
1000
Leaf length(cm)
(X)

main plots and three days after watering as sub-plots and a split-split-plot with three periods daily as sub-sub-plots. The designs comprised the original randomized block layout of the experiment with one or two systematic subdivisions (days and periods) superimposed on it. Figures 33 and 34 are schematic drawings of the split-plot and split-split-plot, respectively. Four sets of analyses were necessary since the shield-bud type of graftage was available for only the May 5 date. This treatment had to be compared separately in designs similar to the above but which contained four main plots (four types of graftage for a single date) instead of 12 (three types and four dates of graftage).

The analyses of variance were complicated by an unequal number of replications for the types of graftage on each date of graftage, the chip buds and shield buds having four, the veneer grafts, five, and the seedling checks, six. Since it was thought desirable to retain the extra replications of the veneer grafts and seedling checks, over and above the four required for equality, the analyses were made with unequal but proportional subclass numbers in which the variations among replications (blocks) were absorbed into experimental error. In addition to the increase in experimental error, the effects of the unequal number of replications were also manifested in the degree of precision attached to the comparisons involving the different types of graftage, the seedling

Fig. 23. --Diagrammatic sketch of split-plot design used for analyses of variance of the 1953 water loss experiment. Main plots (dates and types of graftage), sub-plots (days after watering). See Table 1 for explanation of symbols.

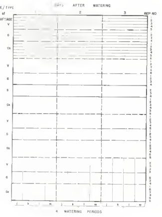
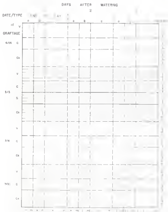


Fig. 24. --Diagrammatic sketch of split-split-plot design used for analyses of variance of the 1953 water loss experiment: Main plots (dates and types of graftage), sub-plots (days after watering), sub-sub-plots (times of day). See Table 1 for explanation of symbols.


DAYS AFTER WATERING
2
DATE/TYPE
of
GRAFTAGE
V
4/14
C
Cs
V
C
5/5
S
Cs
V
7/4
C
Cs
V
7/21
C
Cs

checks having the highest and the shield buds[1] the lowest.

Mean water loss per hour values and averages for six environmental factors were computed for the morning, afternoon, and evening periods of 19 days. The data as collected precluded the use of means of water loss per hour for types of graftage, dates of graftage, or replications, since a single reading was made for air temperature, vapor pressure deficit, wind movement, and light intensity at every weighing. Twelve readings, two per replication, were made for soil temperature and leaf temperature, but they showed a rather small variation from block to block at any given time of day. Consistent differences in these factors between blocks for a particular location on the greenhouse bench or house which might otherwise have existed were masked by shifting the blocks as units after every weighing.

Rates of Water Loss

Daily rates of water loss.--An examination of the daily water loss per hour data for 60 young mango buddings and seedlings prior to analysis revealed the existence of large and variable differences similar to those found the preceding year. As portrayed in the figures in Table 39 representing the sums of four watering periods, and in the first data

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[1]As this type was available for only one date of graftage, comparisons involving it would be less precisely estimated than those with the chip buds which had the same number of replications per date of graftage but were available for four dates.

column of Table 30 showing means on a single watering period basis, the range and magnitude of daily water loss per hour were also markedly different for the various treatments. The order of mean rates for three types of graftage at any given date of graftage (Table 35) was seedling check, veneer graft, and chip bud in the approximate ratio of 2.5:1.5:1. Similarly, the order of mean rates for four dates of graftage was May 5, April 14, July 4, July 21 in the approximate ratio 2:1.5:1.2:1, and for the three days after watering, it was second, third, and first, with respective ratios of 1.2:1.1:1.

After the daily water loss per hour data were subjected to analysis of variance, Table 36, it was found that the ranges in rates among types of graftage (C), dates of graftage (D), and days after watering (T) were all far too large to have been caused by chance variation. The completed analysis of variance, Table 36, showed there was highly significant differences between the veneer grafts (V) and chip buds (C) and between the buddings and the seedling checks (Ck). There was also a highly significant difference between the April 14 (A) and May 5 (B) dates of graftage combined as compared to the July 4 (C) plus July 21 (D) dates although the variations between April 14 and May 5 were non-significant, as were those of the July dates. In the days-after-watering comparisons, the first day was highly significantly different from either the second or the third. Likewise, when the first and third days were

combined, their average performance was highly significantly different from the second day, but that of the first plus the second compared to the third was non-significant. For the interactions of one group of main treatments with another, the dates vs. types of graftage (D x G), dates of graftage vs. days after watering (T x D), and types of graftage vs. days after watering (T x G) comparisons were non-significant, highly significant, and significant, respectively. The additional breakdowns corroborated previous statements made for the main effects and their interactions.

In interpreting the foregoing results, it must be recognized that the daily water losses per hour were subject to bias to the form of plant size, as shown by the stock-stem-area and leaf-area values in Table 4. The seedling checks were larger plants than the budlings, while the leaf areas of the veneer grafts were also larger than those of the chip buds, except in one or two cases. In general, the seedling checks having the greatest expanse of leaf area were assigned, purely by random selection, to the two earlier dates of graftage. The budlings were also readily divisible into two groups, those of the two earlier dates of graftage forming one set and those of the two later dates another.

The influence of plant size on the variations in rate for each day after watering was not discernible. The differences in rate in this case were probably the result of soil moisture conditions in the first few days

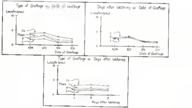
after the plants were watered, as Hendrickson (1921) and Loustalot (1945) both noted that soil moisture was depleted by transpirational losses at a very high rate during the 48-hour period immediately following irrigation. It would appear from a comparison of the soil moisture regimes for the 1952 and 1953 water loss experiments that the magnitude of rate increase was a function of the soil moisture stress developed prior to watering as well as day to day environmental conditions.

The graphic and numerical presentations of the three daily water loss per hour interaction tables, D x G, T x D, and T x G, in Figure 25A and Table 31 for means and Table 29C-E for totals help to explain the conclusions reached in the analysis of variance. For example, it may be noted that the types-of-graftage rates within a given date (Table 31A) varied in a regular pattern, as did the dates-of-graftage values within a given type, the net result being that differences which might have existed tended to cancel themselves out when taken over the entire 12 treatments. The same regularity did not exist, however, in either of the other two interactions. The differences in rate were highly significant for the date-of-graftage vs. days-after-watering interaction (Table 31B). The values for each day after watering showed a straight line (linear) trend against dates of graftage (right hand Figure 25A), but the reverse plot, of dates against days (not shown), revealed an equal

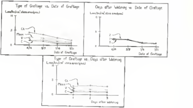
Fig. 25.--A. Daily water loss per hour (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the 1953 water loss experiment: Type of graftage vs. date of graftage, days after watering vs. date of graftage, and type of graftage vs. days after watering.

B. Daily water loss per hour per cm.^{2} stem area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the 1953 water loss experiment: Type of graftage vs. date of graftage, days after watering vs. date of graftage, and type of graftage vs. days after watering.

A.


Type of Graftage vs. Date of Graftage
Loss/hr.(gms.)
CK
Mean
V
C
4/14
5/5
7/4
7/21
Date of Graftage
Days after Watering vs. Date of Graftage
Loss/hr.(gms.)
4/14
5/5
7/4
7/21
Date of Graftage
Type of Graftage vs. Days after Watering
Loss/hr.(gms.)
CK
Mean
V
C
Days after Watering

B.


Type of Graftage vs. Date of Graftage
Loss/hr./cm² stem area(gms.)
CK
Mean
V
C
4/14
5/5
7/4
7/21
Date of Graftage
Days after Watering vs. Date of Graftage
Loss/hr./cm² stem area(gms.)
4/14
5/5
7/4
7/21
Date of Graftage
Type of Graftage vs. Days after Watering
Loss/hr./cm² stem area(gms.)
CK
Mean
V
C
Days after Watering

tendency towards straight line and curvilinear (quadratic and cubic) trends. The differences in rate were significant for the type-of-graftage vs. days-after-watering interaction (Table 31B). The trend of type of graftage against days after watering was distinctly curvilinear, indicating that the rates rose to a maximum, not necessarily the same for each type of graftage, and then dropped.

The major inferences[1] which may be drawn from the daily water loss per hour data are that rates of loss by veneer grafts, chip buds, and seedling checks are different when dates of graftage are ignored, and rates of loss by plants of four dates of graftage fall into two separate groups when types of graftage are ignored. The rates of the plants taken as a group differ according to the number of days after watering.

In addition to the analysis on a per-plant basis, the daily water loss per hour data for 12 treatments were converted to rates per cm.^{2} stock stem area and to rates per 10 dm.^{2} leaf area for the purpose of removing the plant size bias mentioned previously. The converted values were subjected to analyses of variance.

The means for main treatments of daily water loss per hour per cm.^{2} stock stem area are shown in the second data column of

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[1]Based on a statistical probability of the differences noted being the result of chance in less than one per cent of the observations.

Table 30; the corresponding means for interactions are listed in Table 32 and illustrated in Figure 25B. The analysis of variance is given in Table 37.

The daily loss per hour per 10 dm.[2] leaf area data were analyzed twice, once with four chip-bud replications and once with three chip-bud replications. As may be seen from a perusal of the right hand data columns of Table 30 for main treatment means and Tables 33 and 34 for means of the interactions, the water loss rates were influenced to a marked degree by the chip-bud treatments, particularly for the July 4 and July 21 dates of graftage (Tables 33 and 34). A study of the original data showed that two plants, number 33 in the July 4 group and number 76 in the July 21 group (Table 4), had extremely small leaf areas during part or all of the test period so that a very small daily loss of water produced an extremely high rate per unit leaf area, many times higher than that of any other plant in the entire experiment. Since removal of just these two plants would have given disproportionate numbers, it was necessary to remove an entire replication, or one plant from each date of graftage, before reanalyzing the data. The analysis of variance for daily water loss per hour per 10 dm.[2] leaf area with four chip-bud replications is given in Table 38 and that with three chip-bud replications[1]

[1]This analysis and the chip-bud (*C) treatment with three replications have both been given asterisks to minimize confusion with the analysis with four chip-bud replications.

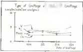
in Table 39. The means of the interactions for the latter are shown graphically in Figure 26.

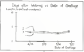
The relationships of the four daily water loss analyses are summarized in Tables 30 and 35 for main treatment means and "F" values, respectively. (The latter were obtained from the analysis of variance tables by dividing the mean square for a given treatment or interaction by the appropriate mean square for error. Since the "F" values are ratios, their magnitude indicates the level of probability for each comparison.)

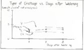
It may be noted in Table 35 for "F" values that converting daily water loss values to a unit-stock-stem-area basis changed the conclusion previously reached for values on a per-plant basis in but two cases of note. The comparison between veneer grafts and chip buds showed that differences to rates of the two treatments on unit-stock-stem-area basis were apparently the result of chance variation; on the other hand, the buddings vs. seedling check comparison revealed a much higher probability level (i.e., very highly significant) than was found on a plant basis. The days-after-watering vs. date-of-graftage interaction was non-significant on a unit-stock-stem-area basis.

All of the comparisons for daily water loss per hour per 10 dm.^{2} leaf area (4 chip-bud replications) were non-significant except that between buddings and seedling checks. As may be seen from the full

Fig. 26.--Daily* water loss per hour per 10 dm.^{2} leaf area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the 1953 water loss experiment: Type of graftage vs. date of graftage, days after watering vs. date of graftage, and type of graftage vs. days after watering.


Type of Graftage v Graftage
10
V
5
C
Mean
Ck
0
4/14
5/5
7/14
7/21
Date of Graftage


Days after Watering vs Date of Graftage
10
5
2
3
0
4/14
5/5
7/14
7/21
Date of Graftage


Type of Graftage vs. Days after Watering
10
5
V
Mean
C
Ck
0
1
2
3

analysis of variance, Table 38, the experimental error (a) mean square, used for testing date-of-graftage and type-of-graftage treatment effects, was about the same magnitude as the corresponding sum of squares in the other three analyses, or roughly 50 times normal size. In contrast, several of the comparisons for daily water loss per hour per 10 dm.[2] leaf area (three ship-had replications) were either significant or highly significant, the most notable being budlings vs. seedling checks and first vs. second and first vs. third days after watering. The analyses showed that plants of any date of graftage had essentially the same rates of loss per unit leaf area but there were differences in the rates of the two types of budlings and of the seedling checks.

It may be noted from the values in Tables 31 and 34 and the lines in Figures 25A and 26 that the order of rates for the three types of graftage changed markedly from the per-plant to the unit-leaf-area basis. Any of four factors may have contributed: a lower unit-leaf-area rate for the seedling checks as compared to the budlings on the basis of varietal characteristics, differences in rates as the result of a larger cross-sectional stem area at the union in the case of the budlings, variations in rate as the result of differences in total leaf area per plant, or variations in rate as the result of pathological conditions. Unlike the data for daily water loss per unit leaf area of Zill budlings and Turpentine seedlings in the 1952 experiment, which showed few differences

attributable to the varieties as such (compare leaf areas to Table 2 with rates of loss to Figures 2 to 7 or 8 to 15), the Haden budlings of the 1953 experiment had a higher rate of water loss per unit leaf area than the Turpentine seedling checks.

The differences to rate noted between budlings and seedling checks were undoubtedly influenced by pathological conditions since many of the leaves on the latter plants were infected with anthracnose (Colletotrichum gloeosporioides) and mango scab (Elsinoe mangiferae) Dufrenoy (1915), Childers, Marshall, and Brody (1941), and Loustalot and Hamilton (1941), among others, have reported that rates of water loss were adversely affected by disease or insect depredations.

Except for the extremely high rates of water loss found for plants with very small leaf areas, the chip-budded Haden plants showed lower rates per unit leaf area than the veneer grafts in spite of the fact that the latter had a larger total leaf area per plant in nearly all cases (Table 4). If it was assumed, however, that the budlings of a given date of graftage had the same potential rate of water loss per unit area, the differences in actual rates noted between veneer grafts and chip buds appeared to be a function of the relative area of contact of the stem tissues[1] formed after graftage at the point of union between

[1]See comments by Soule (1951b) as the anatomical features of mango graft unions.

scion and rootstock.

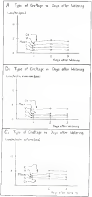
As noted at the beginning of the discussion of daily water-loss rates, the shield-bud treatment was available for the May 5 graftage date only. A separate group of analyses were made on the data gathered from the plants of the May 5 graftage date for daily water loss per hour on a per-plant basis, on a unit-stem-stock-area basis, and on a unit-leaf-area basis. The original data (sum of four watering periods) are shown in Table 40, the means for main treatments in Table 41, the means for interactions in Tables 42, 43, and 44 and Figure 27, a summary of "F" values in Table 45, and the analyses of variance in Tables 46, 47, and 48.

In general, the analyses for four types of graftage on the May 5 date gave the same conclusions as those for three types of graftage and four dates on a per-plant basis, unit-stem-area basis, or unit-leaf-area basis. The major exceptions were the reversal in order of mean rates of water loss on a unit-leaf-area basis (Figure 27C and Table 41) for the veneer-graft and chip-bud treatments and the non-significance of the veneer-graft vs. chip-bud comparison. It may be seen in Table 46 that differences in rates of the three types of buddings and the seedling checks were far larger than could be expected on the basis of chance variation. The shield-bud rates were definitely unlike the seedling-check rates on a per-plant or unit-stock-stem-area basis but had a

Fig. 27.--A. Daily water loss per hour (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1955 water loss experiment: Type of graftage <u>vs</u>. days after watering.

B. Daily water loss per hour per cm.^{2} stem area (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1953 water loss experiment: Type of graftage <u>vs</u>. days after watering.

C. Daily water loss per hour per 10 dm.^{2} leaf area (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1953 water loss experiment: Type of graftage <u>vs</u>. days after watering.


A Type of Graftage vs Days after Watering
10
5
0
Ck
V
Mean
C
S
1
2
3
Days after Watering
B. Type of Graftage vs Days after Watering
10
5
0
Ck
Mean
V
C
S
1
2
3
Days after Watering
C. Type of Graftage vs Days after Watering
10
5
C
V
Mean
S
Ck
2
3

rather low probability level on a unit-leaf-area basis. When compared with chip buds, the shield-bud rates differed by a significant amount on a leaf-area basis only. When compared with veneer grafts, they differed by a probability level of 1 in 100 on a per-plant basis only. A similar level of probability was attached to comparisons of the veneer grafts vs. seedling checks and chip buds vs. seedling checks on a unit-leaf-area basis. The differences to rates in veneer graft vs. seedling check comparison on a per-plant basis were probably the result of sampling errors.

In spite of the complex interrelationships shown by the May 8 graftage date analyses, certain inferences may still be made. Regardless of the basis on which they are judged, the rates of budlings and seedling checks are distinctly different. Within the group of budlings, the shield-bud rates differ from those of the chip buds but do not differ from those of the veneer grafts on a unit-leaf-area basis, while the reverse is true on a plant basis. The differences to mean rates of water loss of the three types of budlings on a unit-leaf-area basis, Table 41, appear again to be attributable to variations in the areas of continuous xylem tissue between scion and rootstock.

Rates of water loss during the morning, afternoon, and evening periods of the day.--Data for 60 young mango budlings and seedlings to 12 main treatments—three types and four dates of graftage—were examined to ascertain the relative effect of time of day on hourly rates

of water loss during three days after watering. As noted in 1952, the magnitude of water loss per hour was found to vary greatly in the morning, afternoon, and evening periods from one day to the next. The rates in 1953 were higher as a rule, however, in the morning than in the afternoon, while the evening rates were approximately a tenth of the day-time values.

The figures for water loss per hour were analyzed in the same manner as those on daily water loss per hour; i. e., analyses of variance were conducted for rates on a per-plant, unit-stock-stem area, and unit-leaf-area basis, with two sets for the last (one with four chip-bud replications, the other with three). The data for water loss per hour (sum of four watering periods) are shown in Table 49, the means for main treatments in Table 50, the means for first order[1] interactions in Figures 28, 29, and 30 and Tables 51 to 54,[2] a summary of "F" values in Table 55, and the separate analyses of variance in Tables 56 to 59.

The conclusions inferred previously from the analyses of daily water loss per hour have been sustained, in general, for similar main treatments in the water-loss-per-hour analyses. Although the individual

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[1]Interactions between main treatments.

[2]The means for the water loss per hour per 10 dm.^{2} leaf area (four chip bud replications) first order interactions are not given.

Fig. 28.--Water loss per hour (gms.) means (basis of single watering interval) for six sets of treatment comparisons from the 1953 water loss experiment: Type of graftage _vs._ date of graftage, days after watering _vs._ date of graftage, type of graftage _vs._ days after watering, time of day _vs._ date of graftage, type of graftage _vs._ time of day, and time of day _vs._ days after watering.

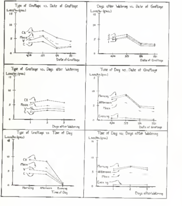

Type of Graftage vs. Date of Graftage
Loss/hr.(gms.)
15
10
5
0
CK
Mean
V
C
Date of Graftage
Days after Watering vs. Date of Graftage
Loss/hr.(gms.)
15
10
5
0
2
3
1
4/14
5/5
7/4
7/21
Date of Graftage
Type of Graftage vs. Days after Watering
Loss/hr.(gms.)
15
10
5
0
CK
Mean
V
C
1
2
3
Days after Watering
Time of Day vs. Date of Graftage
Loss/hr.(gms.)
10
5
Morning
Afternoon
Mean
Evening
4/14
5/5
7/4
7/21
Date of Graftage
Type of Graftage vs Time of Day
Loss/hr.(gms.)
10
5
0
CK
Mean
V
C
Morning
Afternoon
Evening
Time of Day
Time of Day vs. Days after Watering
Loss/hr.(gms.)
15
10
5
0
Morning
Afternoon
Mean
Evening
1
2
3
Days after Watering

Fig. 29.--Water loss per hour per cm.^{2} stem area (gms.) means (basis of single watering interval) for six sets of treatment comparisons from the 1953 water loss experiment: Type of graftage _vs._ date of graftage, days after watering _vs._ date of graftage, type of graftage _vs._ days after watering, time of day _vs._ date of graftage, type of graftage _vs._ time of day, and time of day _vs._ days after watering.

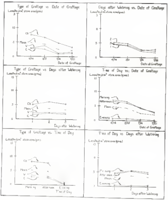
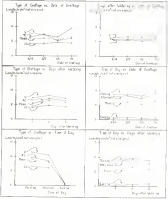

Type of Graftage vs Date of Graftage
Loss/hr./cm² stem area(gms.)
Ck
Mean
V
C
Date of Graftage
Days after Watering vs. Date of Graftage
Date of Graftage
Type of Graftage vs Days after Watering
Ck
Mean
V
C
Days after Watering
Time of Day vs. Date of Graftage
Morning
Afternoon
Mean
Evening
Date of Graftage
Type of Graftage vs. Time of Day
Ck
Mean
V
C
Morning
Afternoon
Time of Day
Time of Day vs Days after Watering
Evening
Days after Watering

Fig. 30. --*Water loss per hour per 15 dm.^{2} leaf area (gms.) means (basis of single watering interval) for six sets of treatment comparisons from the 1953 water loss experiment: Type of graftage vs. date of graftage, days after watering vs. date of graftage, type of graftage vs. days after watering, time of day vs. date of graftage, type of graftage vs. time of day, and time of day vs. days after watering.



Type of Graftage vs. Date of Graftage
Date of Graftage
Type of Graftage vs. Days after Watering
Time of Day vs. Date of Graftage
Morning
Afternoon
Mean
Evening
Type of Graftage vs. Time of Day
Time of Day
Time of Day vs. Days after Watering
Days after Watering

values are larger, the relative order of the mean rates for types of graftage and dates of graftage have remained unchanged (compare Tables 30 and 50), and where the rates were highly significant or non-significant in the daily set, they have remained so, with one exception, when analyzed against time of day (compare Tables 35 and 55). The exception, the veneer-graft vs. chip-bud comparison on a per-plant basis, was highly significant in the daily set but non-significant in the time-of-day set. Similarly, the type-of-graftage vs. date-of-graftage (D x G) comparison (top left Figures 28 to 30 and Tables 51A, 52A, 53A, and 54A for means and Table 55 for "F" values) remained non-significant. The days-after-watering comparisons and interactions with type of graftage and date of graftage (top right and center left Figures 28 to 30 and Tables 51B, C, 52B, C, 53B, C for means and Table 55 for "F" values) showed no marked variations from the conclusions reached earlier.

As shown in Table 50 for means and in Table 55 for "F" values, day-time rates (morning and afternoon) differed greatly from those in the evening. The morning and afternoon values also differed from each other by a highly significant amount. The date-of-graftage vs. time-of-day interaction (right center Figures 28 to 30 and Tables 51D, 52D, 53D, and 54D for means and Table 55 for "F" values) was highly significant on a per-plant or unit-stock-stem-area basis but non-significant on a

unit-leaf-area basis. The type-of-graftage vs. time-of-day interaction (bottom left Figures 28, 29, and 30 and Tables 51E, 52E, 53E, and 54E for means and Table 55 for "F" values) showed highly significant differences on any basis (except leaf area with four chip-bud replications). The last interaction, days after watering vs. time of day (bottom right Figures 28, 29, and 30 and Tables 51F, 52F, 53F, and 54F for means and Table 55 for "F" values), was found to be highly significant when analyzed on a per-plant basis, significant on a unit-stock-stem-area basis, and non-significant on a unit-leaf-area basis.

The reason for the time-of-day vs. date-of-graftage interaction being highly significant on a per-plant or unit-stock-stem-area basis but non-significant on a unit-leaf-area basis is readily apparent in the center right graphs in Figures 28, 29, and 30. In the first two cases, both morning and afternoon rates vary in more or less parallel fashion from one date to the next, while the evening rates show a very different pattern. On the other hand, all three lines in center right Figure 30 are nearly parallel. Similarly, the bottom graphs in Figures 28, 29, and 30 for the interactions of type of graftage vs. time of day and time of day vs. days after watering display unmistakable trends. For example, the seedling checks (Ck) show a more precipitous drop in rate from afternoon to evening in the bottom left graphs of Figures 28 and 29 than in either of the buddings, and in Figure 30 the rates of the two buddings

both fall more sharply than that of the seedling checks. Variations in the slopes of the lines in the bottom right graphs in Figures 28, 29, and 30 for the interaction of time of day vs. days after watering explain the conclusions which were reached in the analysis of variance.

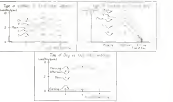
A separate group of analyses were made for the May 5 date of graftage water loss data so that comparisons might be available for the shield-bud type of graftage. Three analyses of variance were conducted, one each for the May 5 figures on a per-plant, unit-stock-stem-area, and unit-leaf-area basis. The data for water-loss-per-hour (sum of four watering periods) are presented in Table 60, the means for main treatments (four types of graftage) in Table 61), the means for first order interactions in Figures 31A, B and 32 and Tables 62, 63, and 64, the "F" values in Table 65, and the analyses of variance in Tables 66, 67, and 68.

Except for the means being larger in size, the data for water loss during three times of the day revealed conclusions essentially different from those shown by the daily water loss values for the May 5 graftage date main treatments or interactions in only three instances. The veneer-graft vs. chip-bud comparison was highly significant for water loss per hour on a unit-leaf-area basis; the days-after-watering comparison was highly significant for water loss per hour on any basis; and comparisons of the first vs. second and first vs. third days after

Fig. 31.--A. Water loss per hour (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the May 5 graftage date of the 1953 water loss experiment: Type of graftage vs. days after watering, type of graftage vs. time of day, and time of day vs. days after watering.

B. Water loss per hour per $cm.^2$ stem area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the May 5 graftage date of the 1953 water loss experiment: Type of graftage vs. days after watering, type of graftage vs. time of day, and time of day vs. days after watering.

A


Ch
V
Mean
C
S
Morning
Afternoon
Mean
Evening

B.

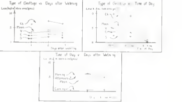
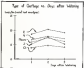
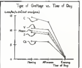

Type of Genotype vs Days after Watering
Ch
Mean
V
C
S
Days after watering
Ch
Mean
V
C
S
Time of Day vs Days after Watering
Morning
Afternoon
Mean
Evening

Fig. 32.--Water loss per hour per 10 dm.^{2} leaf area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the May 5 graftage date of the 1953 water loss experiment. Type of graftage *vs.* days after watering, type of graftage *vs.* time of day, and time of day *vs.* days after watering.


Type of Graftage vs. Days after Watering
Loss/hr./sq.dm.² leaf area(gms.)
15
10
5
0
C
V
Mean
S
Cl
1
2
3
Days after Watering


Type of Graftage vs. Time of Day
Loss/hr./sq.dm.² leaf area(gms.)
15
10
5
0
C
V
Mean
S
Cl
Morning
Afternoon
Evening
Time of Day


Time of Day vs Days after Watering
Loss/hr./sq.dm.² leaf area(gms.)
10
5
0
Morning
Afternoon
Mean
Evening
1
2
3
Days after Watering

watering were highly significant for water loss per hour on a unit-stock-stem-area basis (compare Tables 46 and 65). The interaction of type of graftage with days after watering was uniformly non-significant. The time-of-day rates were highly significant throughout (Table 65), but the morning vs. afternoon comparison was significant for water loss per hour only on the basis of unit leaf area.

The interaction of types of graftage with time of day was highly significant throughout, but that for days after watering vs. time of day was non-significant. The graphic presentations of the means for the interactions (single-watering-period basis) in Figures 31A, 31B, and 32, for water loss per hour on a per-plant, unit-stock-stem-area, and unit-leaf-area basis, respectively, reveal the reasons for the significance or non-significance of the various comparisons.

It is of considerable interest in these and the preceding graphs for interaction means to note the relative order of the types of graftage rates from one basis of measurement to another. For example, the shield-bud rates are the lowest of the four in Figures 31A and 31B but are the next to the lowest in Figure 32. The seedling-check rates are the highest in the first two sets of graphs and the lowest in the third. As stated earlier, the low rates per unit leaf area for the seedling checks may have been the result of a varietal characteristic, a reduction caused by fungus diseases on the leaves, or by a relatively small area of water

conducting tissue in the stem.[1] The status of the shield bud among the buddings may be attributed in a less well-healed union or a smaller area of continuous xylem tissue from rootstock to scion.

In a recapitulation of rates of water loss by young mango buddings and seedlings, it may be stated that buddings and seedlings differ markedly in their rates of water loss, the former having lower rates on a per-plant basis and the latter on a unit-leaf-area basis. There are also clear cut differences between veneer grafts and chip buds on a unit-leaf-area basis, the former having the higher rates. Shield buds have lower rates of water loss than either of the other two types of buddings, but the differences are clear cut only when the rates are on a unit-leaf-area basis. The plants of the four dates of graftage fall into two groups--April 14-May 5 and July 4-July 21--when their rates are on a plant basis, but they do not differ on either a unit-stock-stem-area or a unit-leaf-area basis. The rates of water loss by buddings and seedlings are higher in the morning than in the afternoon. The mean water loss on a per-plant basis for the morning is about 44 per cent, for the afternoon, 41.2 per cent, and for the evening, 14.8 per cent of the daily total.

Two factors whose existence must be recognized, if only

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[1] Soule (1951b) has shown the diameter of xylem vessels in be larger in tissues laid down by plants subsequent in graftage than prior in it.

tarity, are the size and composition of plant sample for each type of graftage and the environmental conditions under which the 1953 water loss experiment was conducted. As shown in Table 5, five veneer-graft, four chip-bud, and six seedling-check replications were available for each of four dates of graftage, and four shield-bud replications for one date of graftage; thus, the true mean rates of water loss were most precisely estimated for the seedling checks and least so for the shield buds.

Considering the wide range in rates from one plant to another within the same type (and date) of graftage shown by the 1953 and 1952 experiments, the inferences from the data should not be applied indiscriminately to all young mango plants under all environmental conditions. On the other hand, the inferences which have been made could serve as a general guide in such circumstances if at the same time due recognition is taken of the fact that their general validity must be substantiated over a series of similar experiments, preferably in different years and under a variety of environments. As they stand, the conclusions are regarded as being applicable to the particular varieties, types of graftage, ages of plants, and environmental conditions of the two years' experiments.

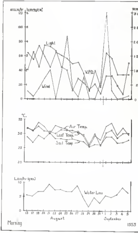
Effect of Certain Environmental Factors on Rates of Water Loss

As stated in the Introduction, one of the major objectives of the water loss experiments was to ascertain the effect of six environmental factors on rates of water loss of young mango budlings and seedlings. It was not possible, for reasons given previously, to compare the rates for different types and dates of graftage with environmental factors, but the differences between treatments were minimized insofar as possible within the limits of the experiment, since the plants in each block or replication were shifted from one location to another on the greenhouse bench and boxes after every weighing.

Mean water loss per hour and average air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature values are presented in Tables 69, 70, and 71 for the morning, afternoon, and evening periods, respectively, of 19 days in 1953. They are illustrated in Figures 33, 34, and 35.

As one may readily see from the figures, the effects of the environmental factors, taken either collectively or individually, on the rates of water loss for any period of the day were rather complex, so much so that interpretations based on visual observation alone were considered to be of little value. The data for each period and the totals of each period ("within periods") were subjected to multiple regression analysis. A summary of the correlation coefficients, means, partial

Fig. 33.--Mean water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), wind movement (10 cu. m./hr.), light intensity (lumens/cm.^{2}), soil temperature (° C.), and leaf temperature (° C.) for the morning period of 19 days in 1953.



m.m.Hg
Light
V.P.D.
Wind
°C.
Air Temp.
Leaf Temp.
Soil Temp.
Loss/hr (gms.)
Water Loss
13 17 18 20 21 22 24 25 26 27 28 29 30 31 1 2 3 4 5
August
September
Morning
1953

Fig. 34.--Mean water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), wind movement (10 cu. m. / hr.), light intensity (lumens/cm.^{2}), soil temperature (° C.), and leaf temperature (° C.) for the afternoon period of 19 days in 1953.

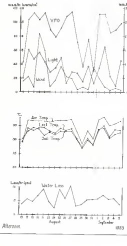
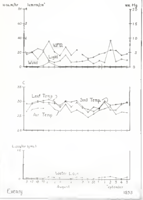

mm.Hg
VPD
Light
Wind
°C.
Air Temp.
Leaf Temp.
Soil Temp.
Loss/hr (gm.)
Water Loss
August
September
Afternoon
1953

Fig. 35. --Mean water loss per hour (gms.), air temperature (° C.), vapor pressure deficit (mm. Hg), wind movement (10 cu. m. / hr.), light intensity (lumens/cm.^{2}), soil temperature (° C.), and leaf temperature (° C.) for the evening period of 19 days in 1953.



lumens/cm²
mm Hg
V.P.D.
Light
Wind
C
Leaf Temp
Soil Temp
Air Temp
Loss/hr (gms)
Water Loss
August
September
Evening
1953

regression coefficients, and multiple regression equations is presented in Table 72.

The total correlation coefficients, expressing the relationship between mean water loss and the six environmental factors taken collectively, were found to be large enough that the combined effect of the environmental factors on mean water loss rates could not have been the result of sampling variation during any of the three periods of the day or their combination. They showed that approximately 56 per cent of the variations in mean water loss rates could be accounted for in the morning period, 59 per cent in the afternoon, 32 per cent in the evening, and 32 per cent in "within periods". The "within periods" coefficient was the average correlation of the three periods. The total as well as the partial and the simple correlation coefficients, which are discussed in the following pages, all showed that the environmental factors were interrelated to a rather high degree. The six factors did not account for more than a relatively small proportion of the variability in rates of water loss at any given time of day. In other words, unknown factors had at least as great an effect on rates of water loss as those which were measured.

It may be noted in Table 72 that the means of rates of water loss and of the environmental factors were substantially alike in the morning and afternoon, whereas those in the evening were much smaller

in nearly all cases. A certain amount of overlapping in the range of the individual values around their means undoubtedly existed.

The partial correlation coefficients, expressing the relationships between mean water loss rates and one of the environmental factors while holding the remaining five constant, were found to be highly significant for light in the evening period and non-significant for all of the others.

The marked influence of light on the variations in the evening water loss rates appeared to be a consequence of the time at which the light intensity readings for this period were taken. The evening light intensity values were averaged from readings made about four o'clock in the afternoon and about eight o'clock in the morning and reflected the fact that the evening period actually included between four and five hours of daylight.

The influence of soil temperature seemed to be manifested more strongly than that of several of the other factors as a result of a daily lag behind air temperature (and thus of other atmospheric factors) of from two to three hours and to the amount of four to five degrees at the time of the afternoon weighing. At the morning weighing, air and soil temperature usually coincided within a few tenths of a degree and, at the noontime weighing, the former was normally several degrees higher.

While the effects of air temperature, vapor pressure deficit,

wind movement, and leaf temperature were all too small to show a significant influence on water loss rates at any time of the day, the relative size of their partial correlation coefficients differed from one period to another. For example, wind movement ($r_{y3.12456}$) showed the smallest effect of any factor in the morning, but the largest in the afternoon, and the next to the smallest in the evening.

The simple correlation coefficients, expressing the relationship between mean water loss per hour and each of the six environmental factors, showed that soil temperature or leaf temperature when taken separately had a highly significant influence on water loss rates in the morning. Air temperature and vapor pressure deficit were found to have a significant effect on rates in the morning and in the evening. Vapor pressure deficit, wind movement, and leaf temperature were all significant in the afternoon. The "within periods" column revealed that the average correlations of the periods for five of the six factors were too large to be attributed to sampling variation; wind movement, alone of the factors, was non-significant.

The foregoing results indicate that no one factor was responsible for more than a small portion of the combined influence of environmental conditions on mean water loss rates at any given period of the day, despite the fact that the total environmental effect was significant for any period and highly significant over the entire day. Taken individually,

the factors often exerted decisive influence over water loss rates. Only one of the six, vapor pressure deficit, showed a consistent effect on rates during each of the three periods, but all of the factors except wind movement were influential over the entire day.

The partial regression coefficients, expressing the change in mean water loss rate with unit increase of one environmental factor while holding the other five constant, reflected the marked variability in the effect of an environmental factor from one period to the next. Wind movement, alone of the six factors, did not have a depressing influence on water loss rates at some time of the day. The large number of negative coefficients served to explain the lower mean rate of water loss in the afternoon period, despite higher mean values for four of the six environmental factors, as compared to that of the morning.

Since the correlation coefficients in Table 72 provided evidence that the effect of a given environmental factor, or of all six factors collectively, on rates of water loss differed in the morning, afternoon, and evening periods, two additional tests were made on the data to confirm the conclusions drawn previously: (a) Tests of significance were made on the partial regression coefficients for each factor to compare pairs of periods, morning vs. afternoon, morning vs. evening, and afternoon vs. evening, Table 73. (b) The values for the six environmental factors taken separately were subjected to analysis of covariance, Tables 74 to 79.

The tests of significance made on the partial regression coefficients (Table 73) revealed that an effect not attributable to sampling variation (with odds of less than one in 20) existed only in the case of the afternoon vs. evening comparison for light intensity. In this instance, the influence of light intensity on rates of water loss was definitely different in the afternoon than in the evening, provided the other factors were held constant.

The analyses of covariance for the individual environmental factors, presented in Tables 74 to 79 for air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature, respectively, revealed what would take place when the rates of water loss for each period were compared with each factor after due allowance was made for day-to-day variations of the given factor. As mentioned in the discussion on analyses of covariance for the 1952 data, each analysis--except that for light intensity--consisted of three parts: (a) the comparison of mean rates of water loss for the morning, afternoon, and evening periods after the rates were adjusted to a common level of the given factor; (b) the proportion of the unexplained variability of the unadjusted period means removed by the analysis; and (c) a comparison of rates of water loss adjusted to a common level of the given factor within each of the three periods. The analysis for light intensity included a fourth section in which the trend of rates

of water loss within each period was tested against that of the period means.

The analysis for air temperature, Table 74A, permits the conclusion that the adjusted mean rates of water loss for each period were sufficiently different as to practically eliminate the possibility of chance variation. This test bears out the interpretation given previously to the results for time of day in the analysis of variance, Table 56. Table 74B indicates that the analysis of covariance removed a large proportion of the variability of the (unadjusted) mean rates of water loss. The figures in Table 74C show that after the rates of water loss within a given period were adjusted to a common air temperature the remaining differences could be attributed to chance. The direction of the influence of air temperature from one day to another thus did not differ for the same time of day, although other environmental factors also played a substantial role.

The analysis for vapor pressure deficit, Table 75, affords conclusions similar to those just mentioned for air temperature except that the effects of vapor pressure deficit on rates of water loss within each period were far greater than could be expected by chance alone. These data show that the effect of vapor pressure deficit on rates of water loss was not only different during the morning, afternoon, and evening, but it also varied from day to day. It is obvious that

environmental factors other than vapor pressure deficit exercised a controlling influence over rates of water loss. The analysis for wind movement, Table 76, presents the same conclusions as those for air temperature except that the increase in precision in the analysis of covariance, Table 76B, was non-significant. The latter result would indicate that the effects of wind movement on rates of water loss are too variable to reduce the unexplained variations in the mean rate for each period by significant amounts. The analysis for light intensity, Table 77, reveals the same conclusions as those for air temperature; however, as shown in Table 77D, the water loss rates within each period followed a trend different from that of the period means, the divergence being highly significant. In this case, the influence of light intensity not only varied from day to day for the same time of day, but the trend was also different from the effect on rates in the three periods. Any effect which this factor might have had was obscured by other environmental factors. The analyses for soil temperature and leaf temperature, Tables 78 and 79, respectively, provide conclusions identical to those for air temperature.

The results of the analyses of covariance permit the inference that none of the six environmental factors which were measured exercised a controlling influence on rates of water loss despite their being highly significant in most instances. Adjustment of rates of water loss

to a common level of a given factor removed a substantial proportion of the unexplained variation. Enough of the latter remained, however, to indicate that other environmental factors were probably of at least equal importance. In the case of vapor pressure deficit, the effect of this factor on rates of water loss differed from one period to the next to a highly significant degree, and with light intensity, the direction of the effect varied as well. The influence of the remaining factors on rates was non-significant, but divergences during the morning, afternoon, and evening periods were readily apparent. To sum up the situation, the analyses of covariance emphasized the interpretations made previously; i. e., the effects of the environmental factors on rates of water loss are interrelated to a rather high degree, and the six factors which were measured did not account for more than a relatively small proportion of the variability in rates at any given time.

V. SUMMARY AND CONCLUSIONS

1. Young veneer-grafted Zill mango budlings and Turpentine mango seedlings grown in closed and open containers under greenhouse conditions showed lower rates of water loss per hour when watered at 28-day intervals than at 14-day intervals over a period of 112 days from August 18 to December 4, 1952.

2. Daily rates of water loss per hour were found to reach a maximum between four and eight days after watering and a minimum between 23 and 27 days after watering.

3. The daily rates of water loss per hour for plants grown in closed containers were generally lower for seedlings than for budlings, but the reverse was true for plants in open containers.

4. When daily water loss per hour was converted to a unit-leaf-area basis, the rates were found to vary widely from plant to plant.

5. Average rates of water loss per hour were higher as a rule in the afternoon than in the morning and very low in the evening but varied widely from day to day; approximately 40 per cent of the water loss over a 24-hour period occurred in the morning, 50 per cent in the afternoon, and 10 per cent in the evening.

6. The average water losses on a per-plant basis during a typical day (September 17, 1952) shortly after watering were 76.2 gms.

to the morning, 95.8 gms. in the afternoon, and 17.1 gms. in the evening.

7. Multiple regression analyses were run on average loss per hour and three environmental factors--air temperature, vapor pressure deficit, and soil temperature--for the morning, afternoon, and evening periods of 73 days in 1952.

8. The combined influence of air temperature, vapor pressure deficit, and soil temperature on average water loss per hour during the morning, afternoon, and evening periods was found to be highly significant.

9. With certain exceptions, each of the three environmental factors was found to have a highly significant effect on average water loss per hour during three periods.

10. Despite the validity of the previous statements (8 and 9), no one of the three environmental factors was found to have a controlling influence on rates of water loss at any time; in most instances, the factors measured did not account for more than a small proportion of the variability in rates, and a high degree of interrelation existed among the factors.

11. Multiple regression analyses made on samples of mature and juvenile leaves collected from bearing Haden mango trees showed total correlations of .954 and .981 between leaf area and leaf length and width.

12. Curvilinear regression analyses made on samples of mature and juvenile leaves of bearing Haden mango trees and of uninjured and malformed leaves of young potted Turpentine mango seedlings revealed correlations ranging from .899 to .973 between log leaf area and log leaf length.

13. The water losses of 64 young Haden mango buddings and Turpentine mango seedlings, under greenhouse conditions, to 13 treatments, four types of graftage (veneer graft, chip bud, shield bud,[1] seedling check) and for four dates of graftage (April 14, May 5, July 4, July 21), were measured during the morning, afternoon, and evening periods of 19 days between August 13 and September 5, 1953; the data as water loss per hour were reduced for purposes of statistical analysis to three days after watering by combining corresponding days to each of four watering intervals.

14. The daily rates of water loss per hour of veneer grafts and chip buds were found to differ by highly significant amounts on a per-plant or a unit-leaf-area basis when dates of graftage were ignored; the rates of shield buds differed from veneer grafts on a per-plant basis and from chip buds on a unit-leaf-area basis.

15. The daily rates of water loss per hour of three types of

[1]May 5 graftage data only.

budlings and seedling checks differed by highly significant amounts when dates of graftage were ignored.

16. The daily rates of water loss per hour of the four dates of graftage comprised two groups, April 14-May 5 and July 4-July 21, on a per-plant basis but did not differ on the basis of either unit stock stem area or unit leaf area.

17. The daily rates of water loss per hour of all plants on the first day after watering were lower than those on either the second or the third day by highly significant amounts.

18. The rates of water loss per hour over three periods a day of veneer grafts and chip buds were found to differ by highly significant amounts on a unit-leaf-area basis when dates of graftage were ignored; the rates of shield buds differed from those of veneer grafts on a per-plant basis and from chip buds on a unit-leaf-area basis.

19. The rates of water loss per hour of three types of budlings differed from those of seedling checks by highly significant amounts when dates of graftage were ignored.

20. The rates of water loss per hour of the four dates of graftage comprised two groups, April 14-May 5 and July 4-July 21, on a per-plant basis.

21. The rates of water loss per hour of all plants on the first day after watering differed from those on thr second day on a per-plant,

unit-stock-stem-area, or unit-leaf-area basis but differed from those on the third day only on a per-plant basis.

22. Highly significant differences were found in the rates of water loss per hour of plants during the morning and afternoon periods as well as of plants in the daytime and the evening.

23. The mean daily loss of water on a per-plant basis was 59.5 gms. and on a unit-leaf-area basis, 80.5 gms. Forty-four per cent of the mean daily loss of water occurred in the morning, 41.2 per cent, in the afternoon, and 14.5 per cent, in the evening.

24. Multiple regression analyses were conducted on mean water loss per hour and six environmental factors--air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature--for the morning, afternoon, and evening periods of 19 days in 1953.

25. The total correlation coefficients for mean water loss per hour and six environmental factors taken collectively were significant for each of the morning, afternoon, and evening periods.

26. The partial correlation coefficients for mean water loss per hour and one environmental factor while holding the remaining five constant were highly significant for light in the evening period.

27. The simple correlation coefficients for mean water loss per hour with each environmental factor taken separately were highly

significant for soil temperature and leaf temperature in the morning; they were significant for air temperature in the morning and evening, for vapor pressure deficit in the morning, afternoon, and evening, for wind movement in the afternoon, and for leaf temperature in the afternoon.

28. Despite the validity of the previous statements (25, 26, and 27), no one of the six environmental factors was found to have a controlling influence on rates of water loss at any time; in most instances, the factors measured did not account for more than a small proportion of the variability in rates, and a high degree of interrelation existed among the factors.

TABLE 1

KEY TO SYMBOLS USED IN TABLES AND FIGURES

D - Dates of graftage (A, B, C, D)

- A - April 14
- B - May 5
- C - July 4
- D - July 21

G.- Types of graftage (V, C, S, Ck)

- V - veneer graft (5 replications)
- C - chip bud (4 replications)
- *C - chip bud (3 replications)
- S - shield bud (4 replications)
- CK - seedling check (6 replications)

T - Days after watering (1, 2, 3)

P - Times of day (a, b, c)

- a - morning
- b - afternoon
- c - evening

D x G, T x D, etc., are interactions of the appropriate treatments

d.f. - degrees of freedom

n.s. (non-significant) - The variations or differences in the values (rates) being compared are small enough that they are probably the result of sampling errors.

* (significant) - The differences are sufficiently large that there is less than one chance in twenty that they are the result of sampling errors.

** (highly significant) - The differences are sufficiently large that there is less than one chance in 100 that they are the result of sampling errors.

TABLE 1 -- continued

Student's "t" and tabular values for "F" were obtained from Snedecor (1946).

$R_{y.123456}$ - Total (multiple) correlation coefficient of dependent variable (Y) and independent variables (X_1, X_2, X_3, X_4, X_5, X_6).

$r_{y1.23456}$ - partial correlation coefficient of dependent variable (Y) and independent variable (X_1) while holding the remaining independent variables (X_2, X_3, X_4, X_5, X_6) constant.

r_{y1} - simple (linear) correlation coefficient of dependent variable (Y) and independent variable (X_1).

$b_{y1.23456}$ - partial regression coefficient of dependent variable (Y) on independent variable (X_1) while holding the remaining independent variables (X_2, X_2, X_4, X_5, X_6) constant.

$\hat{Y}$ or $\hat{Y}$ - expected or predicted values of dependent variable (Y).

$\bar{Y}$, $\bar{X}_1$ - means of Y and X_1, respectively, found by dividing the corresponding total by the number of items included in it.

j - dates for first watering interval: August 20, 21, 22, 1953.

k - dates for second watering interval; for blocks 1, 2, 3: August 24, 25, 26; for blocks 4, 5, 6: August 25, 26, 27, 1952.

l - dates for third watering interval; for blocks 1, 2, 2: August 28, 29, 30; for blocks 4, 5, 6: August 29, 30, 31, 1953.

m - dates for fourth watering interval; September 3, 4, 5, 1952.

TABLE 2

LEAF AREAS (10 DM.^{2}) FOR PLANTS USED IN 1982 WATER LOSS EXPERIMENT

Date of Measurement	Leaf Area (10 dm.^{2}) Plant Number			
	1	2	3	4
Aug. 7[a]	1.890	1.430	1.220	1.660
Aug. 20	1.890	1.430	1.260	1.660
Sept. 11	1.890	1.420	1.260	1.480
Sept. 25	1.880	1.430	1.180	2.040
Oct. 9	1.920	1.430	1.220	2.420
Oct. 23	1.990	1.430	1.220	2.420
Nov. 4	2.090	1.420	1.220	2.420
Nov. 20	2.090	1.430	1.260	2.420
Dec. 4	2.090	1.430	1.230	2.420
	5	6	7	8
Aug. 7	1.130	1.110	1.880	2.120
Aug. 20	1.130	1.110	1.880	2.140
Sept. 11	1.660	1.110	2.220	2.120
Sept. 28	1.620	1.110	2.290	2.660
Oct. 9	1.660	1.110	2.440	2.380
Oct. 22	1.660	1.070	2.440	3.380
Nov. 4	1.710	1.070	2.440	2.380
Nov. 20	1.660	1.070	2.290	3.280
Dec. 4	1.660	1.070	2.390	3.380

[a]Values for each date were calculated from leaf lengths with the following equation: log leaf area (cm ^{2}) = (2 2398 log leaf length (cm) - 1 1282) x 10. $^{-3}$ and plotted on semilogarithmic scale against time (days) to provide for interpolation between dates, dropped leaves were subtracted prorata over the period in which they were lost

TABLE 3

DATES OF GRAFTAGE, TYPES OF GRAFTAGE, AND NUMBER OF PLANTS UTILIZED IN 1953 WATER LOSS EXPERIMENT

Date of Graftage	Type of Graftage	Number of Plants[a]
April 14	Veneer graft[b]	6 (5)
	Chip bud[b]	6 (4)
	Seedling check	6 (6)
May 5	Veneer graft[b]	6 (5)
	Chip bud[b]	4 (4)
	Shield bud[b]	6 (4)
	Seedling check	6 (6)
July 6	Veneer graft[b]	6 (5)
	Chip bud[b]	6 (4)
	Shield bud[b]	5 (0)
	Seedling check	6 (6)
July 21	Veneer graft[b]	6 (5)
	Chip bud[b]	6 (4)
	Shield bud[b]	2 (0)
	Seedling check	6 (6)
		83 (64)

[a]Numbers in parentheses denote plants available for statistical analysis at the conclusion of the experiment Sept. 5, 1953.

[b]Propagated by Mr. Roy Nelson, Superintendent, University of Miami Experimental Farm, Richmond, Florida, in accordance with procedures outlined by Lynch and Mustard (1951).

TABLE 4

STEM AREAS AND LEAF AREAS OF SIXTY-FOUR PLANTS OF 1958 WATER LOSS EXPERIMENT

Plant No.	Plant Code[a] Designation	Stem Area[b] (cm.^{2})	Leaf Area (cm.^{2})[c] Aug. 20	Aug. 24	Aug. 28	Sept. 3
30	2-A-V	1.39	359	389	378	442
38	3-A-V	1.13	860	860	860	860
63	6-A-V	2.19	359	389	359	389
60	8-A-V	1.27	1102	1160	1102	1302
80	4-A-V	1.74	860	860	860	860
1	1-A-C	1.08	478	478	478	478
34	3-A-C	1.27	881	881	881	831
80	6-A-C	1.27	489	489	489	489
77	5-A-C	1.04	601	601	608	830
14	1-A-Ck	.98	1962	1962	1960	1960
19	2-A-Ck	1.09	1780	1780	1780	1780
39	3-A-Ck	1.06	2293	2263	2177	2116
46	4-A-Ck	.79	2439	8439	2439	2439
50	5-A-Ck	.87	1000	1000	1000	943
68	6-A-Ck	.98	1260	1060	1233	1238
8	1-B-V	1.34	714	714	714	714
17	2-B-V	2.11	718	718	718	718
40	3-B-V	2.06	947	947	947	947
69	4-B-V	1.96	860	860	860	860
70	6-B-V	1.43	680	780	832	832
11	1-B-C	2.06	750	780	750	750
29	2-B-C	.99	191	191	191	191
41	3-B-C	8.81	237	237	228	228
49	4-B-C	1.77	798	798	798	798
8	1-B-Ck	.96	1018	1018	1018	1018
16	2-B-Ck	1.09	2271	2271	2271	2271
31	3-B-Ck	.83	1483	1483	1603	1483
82	4-B-Ck	2.78	2470	3268	3461	3871
88	8-B-Ck	1.33	2874	2043	1998	1998
67	6-B-Ck	.92	1067	1067	1067	1014

TABLE 4 -- Continued

Plant No.	Plant Code[a] Designation	Stem Area[b] (cm.^{2})	Leaf Area (cm.^{2})[c] Aug. 14	Aug. 24	Aug. 28	Sept. 3
6	1-C-V	1.41	145	145	145	148
18	3-C-V	2.27	318	322	334	334
48	4-C-V	1.70	542	698	772	768
87	5-C-V	1.52	118	273	436	453
69	6-C-V	1.21	33	217	583	485
18	1-C-G	1.84	161	318	480	668
25	2-C-C	1.61	343	347	348	347
33	3-C-C	1.37	8	8	9	10
53	4-C-C	1.91	347	469	850	834
12	1-C-Ck	1.29	1117	1088	1072	1137
28	2-C-Ck	1.29	709	789	709	789
32	3-C-Ck	.82	746	839	876	822
34	4-C-Ck	1.31	1828	1796	1668	1663
68	5-C-Ck	.92	1151	1181	1181	1151
48	6-C-Ck	1.08	1491	1491	1491	1491
4	1-D-V	1.28	136	136	145	193
38	2-D-V	2.49	209	543	468	366
36	3-D-V	1.81	300	314	320	320
43	4-D-V	1.63	284	356	258	268
59	8-D-V	1.68	417	411	412	426
7	1-D-C	2.83	288	280	429	452
24	3-D-C	1.39	389	389	391	402
76	8-D-C	1.65	2	27	143	402
83	6-D-C	1.81	168	306	424	460
2	1-D-Ck	1.84	1468	1486	1541	1541
26	2-D-Ck	2.19	932	928	983	908
37	3-D-Ck	1.48	1358	1368	1579	1579
44	4-D-Ck	1.77	680	668	668	668
61	8-D-Ck	.99	483	452	483	442
66	6-D-Ck	.83	838	837	847	858

TABLE 4 -- Continued

Plant No.	Plant Code[a] Designation	Stem Area[b] (cm.^{2})	Leaf Area (cm.^{2})[c] Aug. 20	Aug. 24	Aug. 28	Sept. 3
9	1-B-S	1.56	172	172	175	181
72	3-B-S	1.67	269	269	271	277
81	6-B-S	1.33	710	712	714	714
78	5-B-S	1.86	313	340	350	350

[a]Block no., date of graftage (A = April 14, B = May 8, C = July 4, D = July 21), type of graftage (V = veneer graft, C = chip bud, Ck = seedling check, S = shield bud).

[b]Taken as essentially constant over 19-day experimental period; measured on stock at union on buddings and 10 cm. above soil on seedling checks.

[c]Calculated from leaf lengths (cm.) with aid of equations shown in Table 28; interpolations or extrapolations from the dates shown were made from log leaf area plotted against days for each plant. All leaf area values were multiplied by 10^{-3} (to convert from cm ^{2} to 10 dm. ^{2}) for the analyses of variance so that the water loss data would be in terms of grams per plant, per cm ^{2} stem area, per 10 dm. ^{2} leaf area.

TABLE 8

DAILY WATER LOSS PER HOUR (GMS.) DURING FOUR 28-DAY WATERING CYCLES IN 1962 FOR TWO TURPENTINE MANGO SEEDLINGS AND TWO VENEER-GRAFTED ZILL (ON TURPENTINE) BUDLINGS GROWN IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
I	1	8.77	7.32	4.12	6.18	1.88	2.04
Aug. 18-	2	4.36	8.81	2.04	4.77	1.45	1.97
Sept. 11	3[a]	4.36	8.81	2.88	4.77	1.45	1.97
	4	8.06	7.16	3.79	6.74	8.10	2.98
	8	4.94	7.81	3.71	8.24	2.87	4.88
	6	3.78	4.79	8.78	6.67	1.04	2.92
	7	3.13	3.04	2.29	2.88	.41	2.71
	8	1.88	2.92	2.08	3.78	1.04	1.67
	9	1.88	2.39	1.80	2.92	.81	1.04
	10[a]	1.88	2.39	1.88	2.92	.81	1.04
	11	2.08	1.04	2.04	2.92	- .62	.04
	12	2.08	3.04	2.29	3.78	1.46	1.06
	13	1.67	2.29	1.88	2.92	.62	1.04
	14	1.67	1.88	2.08	2.08	.21	0.88
	18	2.08	2.08	2.08	2.92	8.04	.04
	16	1.81	.41	1.66	1.22	- .04	- .16
	17[a]	1.81	.41	1.64	1.82	- .04	- .14
	18[a]	1.81	.41	1.66	1.82	- .04	- .14
	19	1.26	1.98	1.88	2.11	.84	.63
	20	1.28	1.88	1.04	1.04	.62	- .45
	21	.83	.82	1.28	1.46	8.04	.21
	22	1.28	1.67	1.28	.83	.42	- .42
	22	.41	1.46	1.88	.83	1.08	-1.08
	24[a]	.41	1.06	1.88	.83	1.08	-1.08
	28	.83	.42	1.04	.82	- .41	- .41

TABLE 5 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
I	36	.63	.42	.63	.21	-.21	-.42
Aug. 10-	27	.03	1.20	1.35	.03	.42	-.42
Sept. 11	28	.03	1.04	.53	1.00	.21	1.05
(Cont.)							
II	1	3.13	3.75	2.50	3.04	.62	1.04
Sept. 12-	3	4.58	0.03	4.17	0.73	1.30	1.06
Oct. 9	3[a]	4.00	0.03	4.17	0.73	1.20	1.06
	4	6.20	7.00	0.42	0.33	1.30	3.91
	5	6.66	5.15	5.42	7.58	1.66	1.66
	6	6.46	5.13	5.42	5.33	1.66	5.91
	7	5.58	5.00	3.75	5.62	-.00	1.07
	5	0.46	7.05	4.17	7.29	1.68	3.13
	9	3.13	4.17	3.70	3.70	1.04	1.00
	10[a]	3.13	4.17	2.70	3.75	1.04	1.00
	11	3.13	5.27	3.70	5.62	2.14	1.57
	13	3.13	4.79	3.93	0.62	1.46	5.70
	13	2.10	3.37	3.77	3.57	1.19	.00
	14	1.04	1.90	3.30	3.46	.44	.44
	15	1.67	2.92	3.29	3.50	1.25	.31
	16	1.67	2.00	1.98	3.08	.61	.10
	17[a]	1.67	3.08	1.98	3.50	.41	.10
	15	1.67	2.00	3.05	3.05	.53	0.00
	19	1.30	1.46	1.46	1.46	.21	- 0.00
	20	.03	1.46	1.46	1.67	.63	.31
	51	.42	.63	.42	1.04	.21	.62
	23	.03	1.04	1.04	.63	.21	-.41
	33	-.63	.63	.93	.52	5.00	-.41
	24[a]	.63	.63	.93	.02	0.00	-.41
	25	1.30	1.67	.53	1.45	.42	.62

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
II	26	.83	1.28	.83	1.06	.42	.21
Sept. 12-	27	.42	1.28	1.25	1.88	.83	.63
Oct. 9	28	.63	1.25	.42	1.67	.62	1.25
(Cont.)							
III	1	2.08	2.08	1.45	2.08	0.00	.63
Oct. 10-	2	1.98	1.88	1.45	2.70	- .10	1.28
Nov. 6	3[a]	1.98	1.88	1.48	2.70	- .10	1.28
	4	2.88	2.08	1.28	2.29	- .42	1.06
	5	3.88	3.33	2.29	8.00	- .22	2.71
	6	4.17	3.78	1.88	6.79	- .42	2.91
	7	8.03	8.03	6.58	7.88	0.00	2.92
	8	4.88	3.78	2.92	6.08	- .83	1.66
	9	2.17	3.78	2.88	8.00	1.88	2.50
	10[a]	2.17	3.78	2.50	8.00	1.50	2.50
	11	8.00	5.83	4.17	6.67	.83	2.50
	12	3.78	3.54	2.50	8.00	- .21	2.00
	13	2.70	1.58	1.28	2.29	- .02	1.08
	15	2.80	2.92	1.46	3.33	.42	1.87
	18	2.08	2.08	1.48	2.92	- .42	1.66
	16	2.92	4.08	3.02	6.79	1.66	1.77
	17[a]	2.92	4.08	2.03	4.79	1.66	1.77
	18	1.67	2.92	1.66	2.92	1.25	1.66
	19	2.08	3.78	2.70	3.78	1.67	1.08
	20	2.08	3.08	2.88	3.33	1.48	.83
	21	1.67	3.08	2.70	2.70	1.87	0.00
	22	1.08	2.92	2.70	2.29	1.88	- .41
	23	1.18	2.88	2.50	1.77	1.38	- .73
	24[a]	1.18	2.80	2.90	1.77	1.38	- .73
	25	1.25	2.08	2.08	2.08	1.28	0.00
	26	.83	2.29	1.67	1.67	1.46	0.00
	27	.83	1.67	1.28	1.28	.88	0.00
	28	1.28	3.17	2.50	2.78	1.92	.20

TABLE 5 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (5)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-3)
IV	1	2.78	4.58	3.33	4.58	.83	1.00
Nov. 7-	2	3.55	2.67	5.50	3.96	-.10	1.46
Dec. 4	3[a]	3.05	3.57	2.50	3.95	-.15	1.46
	4	4.79	5.00	2.33	5.21	.01	1.00
	5[a]	4.79	3.00	3.33	5.21	.01	1.00
	6	3.95	3.70	5.58	4.55	-.21	3.50
	7	0.50	0.58	1.46	0.58	-.42	1.58
	8	4.50	3.95	5.70	0.50	-.62	2.50
	9	3.78	3.57	2.00	4.58	-.00	2.00
	10[a]	3.75	3.57	2.08	4.50	-.50	0.50
	11	4.17	4.17	2.70	0.42	0.00	2.75
	12	3.78	5.00	2.70	5.04	1.25	3.34
	13	0.00	3.33	1.57	4.58	.03	2.71
	14	2.45	3.68	0.56	2.50	1.23	-.82
	15	1.50	2.39	1.46	2.50	.41	1.50
	16	1.05	0.19	1.38	0.70	.53	1.30
	17[a]	1.05	0.19	1.38	0.70	.53	1.30
	18	5.00	3.13	2.00	4.17	.53	1.09
	19	1.57	3.10	2.50	2.33	1.46	.03
	20	1.05	1.46	1.50	1.67	.51	.43
	21[a]	1.25	1.46	1.50	1.67	.51	.43
	22	1.67	1.48	1.11	1.00	-.19	.74
	23	.78	1.33	1.50	1.25	.55	.33
	24[a]	.75	1.33	1.58	1.33	.00	.33
	25	.03	1.57	1.25	1.25	.50	0.58
	26	1.25	5.50	1.46	1.67	.53	.01
	27	1.58	1.28	1.23	1.28	.30	0.58
	28	3.58	1.46	.03	1.57	.42	.58
Average of 4 Cycles	1	2.68	4.43	2.50	4.00	.75	1.50
	2	2.69	4.58	2.73	4.29	.71	1.55
	3	3.69	4.58	0.73	4.29	.71	1.85
	4	4.65	5.46	3.46	0.50	.79	2.19
	5	4.94	0.07	3.57	0.53	.93	1.96

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
Average of 4 Cycles (Cont.)	6	4.34	5.15	3.28	6.09	.76	2.81
	7	4.24	4.11	3.02	5.16	-.13	2.14
	8	4.11	4.43	2.97	0.16	.32	2.19
	9	2.73	3.57	2.29	4.06	.84	1.77
	15	2.73	3.57	2.29	4.06	.84	1.77
	11	3.62	4.10	3.10	5.16	.40	1.90
	12	3.10	4.22	2.60	5.10	1.04	2.35
	13	2.26	2.72	1.89	3.29	.46	1.40
	14	2.04	3.62	2.15	2.52	.58	.37
	10	2.03	2.84	1.53	2.71	.31	.59
	16	1.79	2.32	2.00	2.00	.03	.58
	17	1.79	2.32	2.00	2.00	.03	.50
	15	1.71	2.23	1.53	2.67	.03	.50
	19	1.56	2.56	2.04	2.66	1.80	.62
	20	1.33	2.59	1.63	1.93	.76	.31
	21	1.04	1.63	1.33	1.72	.55	.39
	22	1.20	1.78	1.03	1.40	.58	-.13
	23	.74	1.48	1.58	1.11	.74	-.47
	24	.74	1.48	1.58	1.11	.74	-.47
	25	1.04	1.07	1.50	1.35	.03	.05
	26	.99	1.01	1.10	1.15	.52	0.00
	27	.77	1.84	1.20	1.30	.09	.05
	58	.98	1.73	1.15	1.98	.79	.03

[a]Sundays or holidays when no readings were taken.

TABLE 6

DAILY WATER LOSS PER HOUR (GMS.) DURING EIGHT 14-DAY WATERING CYCLES IN 1962 FOR TWO TURPENTINE MANGO SEEDLINGS AND TWO VENEER-GRAFTED ZILL (ON TURPENTINE) BUDLINGS GROWN IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (8-6)
I-a	1	4.12	0.58	2.71	6.38	4.12	2.67
Aug. 15-29	2	2.42	4.63	2.13	0.70	2.21	2.37
	3[a]	2.42	4.63	3.13	0.70	2.31	3.37
	4	0.37	7.58	0.06	2.43	2.21	3.37
	5	4.94	6.59	5.36	7.03	1.65	1.47
	6	3.54	4.17	5.00	5.04	.62	.04
	7	2.70	2.92	4.17	4.17	.22	0.58
	8	1.06	1.06	2.30	2.92	0.50	.42
	9	1.57	1.77	2.50	2.60	.20	.10
	10[a]	1.57	1.77	2.50	2.60	.50	.10
	11	2.50	1.44	2.50	1.00	-.58	-.20
	12	1.25	2.75	2.92	2.33	1.45	.41
	13	1.50	1.58	1.67	.02	0.55	-.84
	14	2.93	2.75	2.93	4.79	.53	1.57
I-b	15	4.50	0.54	0.84	0.33	3.44	2.49
Aug. 29-	16	1.02	7.96	4.20	6.37	6.44	2.09
Sept. 11	17[a]	1.32	7.96	4.25	6.37	6.44	2.09
	18[a]	1.02	7.96	4.58	6.37	6.44	2.09
	19	5.50	10.96	6.02	9.67	0.58	2.10
	20	4.79	0.77	6.04	7.30	3.90	1.46
	21	2.73	6.04	4.38	5.45	2.29	1.02
	22	2.84	2.96	4.50	4.50	.42	.20
	23	1.67	2.50	2.29	2.29	.53	0.50
	24[a]	1.67	2.50	2.29	2.29	.83	0.50
	25	2.50	1.67	2.73	2.29	-.41	-.44
	26	1.67	1.67	1.46	1.67	0.50	.50
	27	1.55	1.55	2.92	2.50	.63	-.42
	28	1.67	2.92	2.00	4.17	1.25	2.09

TABLE 6 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (2)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-2)	Difference (Open-Closed) Veneer Grafts (8-6)
II-a	1	2.72	5.04	2.54	6.04	2.09	2.80
Sept. 12-25	2	4.28	5.22	4.58	8.24	3.75	2.80
	3[a]	4.58	8.32	4.60	5.54	3.75	2.80
	4	5.42	10.81	6.87	10.81	5.39	3.94
	5	8.42	8.75	7.59	10.40	2.22	5.11
	6	5.00	9.17	3.04	8.96	4.17	5.42
	7	2.78	5.00	2.96	5.42	1.56	1.46
	8	2.92	5.00	4.79	8.00	2.08	.21
	9	2.50	2.91	2.50	2.91	.41	.41
	10[a]	2.80	2.91	2.50	2.91	.41	.41
	11	2.25	2.80	2.12	2.80	5.58	-.63
	12	2.08	2.10	2.13	2.58	.15	-.62
	13	1.58	2.15	2.10	1.70	.60	-.40
	14	1.76	2.20	1.15	2.42	.40	1.22
II-b	15	4.17	6.58	2.79	5.50	1.55	1.21
Sept. 26-	16	6.22	9.58	4.79	7.92	2.12	2.12
Oct. 9	17[a]	6.28	9.58	4.79	7.92	3.12	2.13
	18	6.82	10.41	5.40	10.41	3.58	8.01
	19	8.38	8.75	4.58	5.22	2.75	3.75
	20	2.54	7.08	2.33	7.08	2.54	3.75
	21	2.29	2.23	1.04	2.33	1.03	1.85
	22	2.05	4.58	2.70	5.00	5.58	2.20
	23	2.29	2.92	2.29	4.00	0.00	1.71
	24[a]	2.29	2.92	5.29	4.58	0.00	1.71
	25	2.58	2.75	2.75	4.15	1.58	.40
	26	1.25	1.67	1.58	2.08	.42	.20
	27	1.08	2.50	2.22	2.70	.42	-.62
	28	1.45	.83	2.70	.82	-.62	-1.87
III-a	1	2.00	2.12	1.40	2.00	1.04	1.05
Oct. 18-22	2	2.29	2.23	1.28	2.70	.94	1.38
	3[a]	2.29	2.23	1.28	2.70	.94	1.28
	4	2.08	3.12	1.45	2.08	1.04	.62
	5	3.78	8.40	1.08	2.92	1.65	1.34

TABLE 6 -- *Continued*

Watering Cycle and Date	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (4)	Veneer Grafts Open (5)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (5-6)
III-a	6	3.75	5.53	2.50	3.94	2.05	1.46
Oct. 15-23	7	5.55	5.75	3.75	6.46	3.75	2.29
(Cont.)	8	3.75	5.53	2.55	5.50	2.55	2.95
	9	3.75	5.40	2.55	5.46	1.58	2.95
	10[a]	2.75	5.50	2.55	5.50	1.58	2.90
	11	3.96	6.25	2.33	7.50	3.29	5.17
	12	3.13	3.75	2.55	5.53	.62	3.33
	13	2.55	2.92	.63	3.33	.84	2.75
	14	2.75	6.17	2.29	4.50	1.67	2.59
III-b	15	1.55	2.70	1.46	3.75	.52	2.79
Oct. 24-	16	3.40	7.71	2.70	7.92	2.31	5.22
Nov. 6	17[a]	5.50	7.71	2.75	7.92	2.31	5.22
	18	2.50	2.96	1.67	4.17	1.44	2.50
	19	4.17	7.58	2.50	7.50	2.91	5.00
	20	4.79	7.33	2.50	7.50	2.46	5.55
	21	3.96	6.46	2.92	5.84	2.50	2.92
	22	4.17	6.25	2.92	5.84	2.55	2.92
	23	3.50	4.55	3.13	4.25	1.16	1.15
	24[a]	3.46	4.58	3.13	4.28	1.16	1.15
	25	2.75	3.75	3.33	3.13	1.55	-.25
	26	2.55	2.92	3.33	2.50	.42	-.53
	27	1.46	2.50	2.55	2.08	1.04	-.42
	28	3.75	6.55	3.33	4.17	.53	.56
IV-a	1	4.50	6.25	2.70	5.53	1.67	3.13
Nov. 7-25	2	4.25	5.62	2.19	3.21	1.34	3.52
	3[a]	4.28	5.62	2.19	5.21	1.34	3.02
	4	4.51	7.08	2.92	6.67	2.27	3.75
	5	4.51	7.08	2.92	6.67	2.27	2.75
	6	3.75	5.50	3.50	5.62	1.25	3.84
	7	2.92	4.17	1.25	3.96	1.25	2.74
	8	3.33	5.21	2.55	5.62	1.55	3.46
	9	2.51	4.56	1.67	4.25	1.27	2.61
	10[a]	2.51	4.86	1.67	4.50	1.27	2.61

TABLE 6 -- Continued

Watering Cycles and Dates	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (8-6)
IV-a	11	3.13	4.17	2.08	4.58	1.04	2.50
Nov. 7-20	12	2.50	3.33	2.50	3.33	.83	.83
(Cont.)	13	1.67	2.08	1.67	2.89	.61	1.22
	16	1.22	2.45	1.43	2.65	1.23	.83
IV-b	15	2.58	3.83	1.25	3.75	1.25	2.00
Nov. 21-	16	2.19	3.70	1.25	3.29	1.51	2.04
Dec. 4	17[a]	2.19	3.70	1.25	3.29	1.51	2.04
	18	4.37	6.25	2.00	7.00	1.88	5.00
	19	4.17	6.58	2.50	7.29	2.41	4.79
	20	2.29	2.60	.73	3.02	.31	2.29
	21[a]	2.29	2.60	.73	3.02	.31	2.29
	22	2.59	3.10	1.11	3.52	.06	2.41
	23	2.67	3.78	.89	4.56	1.11	3.67
	24[a]	2.67	3.78	.89	4.56	1.11	3.67
	25	2.70	3.75	.83	4.38	1.05	3.55
	26	3.13	4.17	1.67	5.00	1.04	3.33
	27	3.13	4.17	1.25	4.38	1.04	3.13
	28	2.50	3.13	1.54	4.38	.63	2.84
Average of	1	3.63	5.87	2.35	5.19	2.24	2.84
4 a Cycles	2	3.54	5.85	2.01	4.69	2.31	2.68
	3	3.54	5.85	2.01	4.69	2.31	2.68
	4	4.40	7.18	4.08	7.00	2.78	2.92
	5	4.73	6.98	4.36	6.98	2.25	2.62
	6	6.01	8.06	3.28	6.10	2.05	2.82
	7	3.59	5.21	3.28	4.90	1.62	1.62
	8	2.97	4.48	2.97	4.74	1.51	1.77
	9	2.70	3.46	2.29	3.80	.76	1.51
	10	2.70	3.46	2.29	3.80	.76	1.51
	11	2.92	3.64	2.41	4.12	.72	1.71
	12	2.24	3.07	2.76	4.60	.83	1.84
	13	1.45	2.11	1.84	2.71	.66	.87
	14	2.15	3.19	1.94	3.56	1.04	1.62

TABLE 6 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (8)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-8)	Difference (Open-Closed) Veneer Grafts (5-6)
Average of 4 b Cycles	13	3.18	5.83	3.50	5.21	1.88	2.13
	16	3.84	6.94	3.26	6.38	3.10	3.12
	17	3.80	6.94	3.26	6.38	3.10	3.13
	18	3.81	7.18	3.36	7.81	3.34	3.63
	19	4.81	8.34	4.03	8.20	3.83	6.17
	50	3.85	6.45	6.15	6.28	2.60	2.13
	21	3.07	4.61	2.48	6.48	1.50	1.92
	22	3.10	4.49	2.78	4.74	1.39	1.96
	23	2.82	3.45	2.15	3.78	.93	1.63
	26	2.32	3.45	2.15	3.78	.93	1.63
	23	2.50	3.25	2.66	3.49	.78	.83
	26	2.14	2.61	2.09	2.51	.47	.72
	27	1.93	2.76	2.80	2.92	.83	.42
	28	2.24	2.57	2.29	3.39	.63	1.18

[a]Sundays or holidays when no readings were taken.

TABLE 7

DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS.) DURING FOUR 28-DAY WATERING CYCLES IN 1952 FOR TWO TURPENTINE MANGO SEEDLINGS AND TWO VENEER-GRAFTED ZILL (ON TURPENTINE) BUDLINGS GROWN IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
I	1	3.00	6.81	2.68	3.72	3.76	.30
Aug. 18-	2	2.31	4.61	1.96	2.87	2.30	.91
Sept. 11	3	2.31	4.61	1.96	2.87	2.30	.91
	4	2.68	6.68	2.60	4.06	3.00	1.41
	5	2.61	5.06	2.59	4.96	2.90	2.37
	6	1.98	3.00	2.62	4.03	1.82	1.40
	7	1.66	2.81	1.60	3.01	1.18	1.41
	8	.99	2.32	1.45	2.26	1.33	.81
	9	.99	1.90	1.31	1.76	.91	.45
	10	.99	1.90	1.31	1.76	.91	.40
	11	1.10	1.16	1.45	1.76	.06	.31
	12	1.10	2.81	1.60	2.26	1.71	.66
	13	.88	1.82	1.31	1.76	.94	.45
	14	.88	1.49	1.45	1.35	.61	-.20
	15	1.10	1.68	1.45	1.76	.88	.31
	16	.83	.33	1.16	.92	-.20	-.23
	17	.83	.33	1.16	.92	-.20	-.24
	18	.83	.33	1.16	.92	-.20	-.24
	19	.67	1.01	1.03	1.27	.30	.24
	20	.68	1.49	1.02	.63	.83	-.39
	21	.44	.66	.87	.88	.22	.01
	22	.66	1.33	.87	.50	.67	-.37
	23	.22	1.16	1.31	.50	.94	-.81
	24	.22	1.16	1.31	.50	.94	-.81
	25	.44	.33	.73	.38	-.11	-.35
	26	.33	.33	.44	.13	0.00	-.31
	27	.44	.99	.87	.50	.00	-.37
	28	.44	.83	.30	1.13	.39	.63

TABLE 7 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
II	1	1.46	3.88	1.72	2.11	1.39	.36
Sept. 18-	2	2.42	4.74	2.92	3.37	2.32	.68
Oct. 9	3	2.42	4.74	2.92	3.31	2.32	.39
	4	3.34	6.15	3.79	4.76	5.76	.97
	5	3.45	6.71	2.79	3.98	3.26	.19
	6	5.68	6.71	2.79	4.61	2.26	.82
	7	2.83	4.13	2.68	3.87	1.18	.45
	8	2.92	5.82	2.92	3.94	5.92	1.02
	9	1.49	5.41	1.59	1.99	1.72	.15
	10	1.69	3.45	1.89	1.96	1.76	.07
	11	1.68	4.26	5.68	2.88	5.68	.26
	12	1.68	2.96	2.04	2.84	5.25	.88
	13	1.17	2.78	1.94	1.78	1.61	- .16
	14	.82	1.67	1.68	1.29	.85	- .25
	15	.89	2.68	1.60	1.21	1.57	- .39
	16	.88	1.75	1.35	.99	.90	- .39
	17	.88	1.76	1.38	.98	.88	- .40
	18	.88	2.12	1.68	.96	1.34	- .49
	19	.66	1.68	1.02	.67	.88	- .35
	20	.43	1.23	1.02	.76	.80	- .26
	21	.22	.52	.29	.47	.20	.15
	22	.43	.56	.73	.28	.43	- .45
	23	.33	.68	.65	.23	.19	- .45
	24	.33	.52	.65	.22	.19	- .43
	25	.68	1.36	.88	.62	.71	.04
	26	.43	1.68	.68	.44	.87	- .14
	27	.22	1.68	.57	.78	.75	- .99
	28	.43	.99	.29	.49	.56	.68
III	1	1.87	1.68	1.81	.86	.28	- .15
Oct. 18-	2	1.82	1.49	1.01	1.12	.47	.11
Nov. 6	3	1.02	1.49	1.81	1.12	.47	.11
	4	1.28	1.45	.87	.95	.57	.68
	5	1.51	2.68	1.68	2.07	.53	.47

TABLE 7 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
III	6	2.13	3.90	1.31	1.98	.88	.67
Oct. 10-	7	2.96	4.63	3.20	3.10	1.67	-.10
Nov. 6	8	2.32	2.98	2.04	1.89	.66	-.15
(Cont.)	9	1.10	3.90	1.78	3.07	1.64	.33
	10	1.10	2.90	1.78	0.07	1.80	.32
	11	3.53	4.63	2.92	2.76	0.10	-.16
	12	1.09	2.01	1.78	2.07	.92	.32
	13	1.56	1.49	.87	.98	.15	.08
	14	1.36	2.32	1.02	1.38	.06	.36
	15	1.28	1.68	1.02	1.21	.40	.19
	16	1.45	3.64	2.11	1.98	3.19	-.13
	17	1.45	0.64	2.11	1.98	0.19	-.13
	18	.03	2.32	1.02	1.21	1.64	.19
	19	1.02	0.90	1.09	1.05	1.96	-.34
	20	1.01	2.01	1.78	1.38	1.80	-.37
	21	.01	2.01	1.09	1.12	2.00	-.77
	22	.51	2.32	1.89	.98	1.01	-.94
	23	.56	1.98	1.78	.73	1.42	-1.02
	24	.06	1.98	1.75	.73	1.42	-1.08
	28	.60	1.98	1.45	.86	1.64	-.59
	26	.45	1.82	1.17	.69	1.42	-.48
	37	.46	1.53	.87	.83	.93	-.38
	28	.60	2.82	1.78	1.12	1.92	-.63
IV	1	1.79	5.64	2.33	1.81	1.85	-.82
Nov. 7-	2	1.64	3.91	1.75	1.64	1.07	-.11
Dec. 4	3	1.80	2.91	1.75	1.64	1.07	-.11
	4	2.29	5.97	2.35	2.18	1.68	-.18
	5	0.29	3.97	2.35	3.18	1.60	-.18
	6	1.89	0.98	1.45	1.89	1.09	.44
	7	1.20	1.60	1.03	1.03	.45	.01
	8	2.19	3.14	1.89	2.07	.98	.18
	9	1.79	2.91	1.45	1.89	1.12	.48
	10	1.79	3.91	1.45	1.89	1.12	.44

TABLE 7 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
IV	11	1.99	2.31	1.69	3.23	1.32	.36
Nov. 7-	12	1.79	2.91	1.59	2.50	2.12	.61
Dec. 4	13	1.25	3.68	1.17	1.61	1.44	.68
(Cont.)	14	1.17	2.92	2.55	.84	1.76	-1.16
	15	.95	1.52	1.02	1.53	.92	.51
	16	.76	1.74	.94	1.12	.99	.18
	17	.76	1.74	.94	1.13	.99	.16
	18	1.35	2.48	1.48	1.73	1.25	.37
	19	.80	2.48	1.75	1.38	1.68	- .37
	20	.60	1.16	.73	.69	.66	- .04
	21	.60	1.16	.73	.69	.56	- .04
	22	.80	1.17	.78	.76	.37	- .02
	23	.37	1.06	.70	.55	.69	- .15
	24	.37	1.06	.70	.55	.69	- .16
	25	.40	1.33	.87	.52	.93	- .35
	26	.60	1.65	1.02	.69	1.05	- .33
	27	.48	.99	.97	.62	.51	- .35
	28	.58	1.19	.58	.69	.69	.11
Average of 4 Cycles	1	1.59	3.04	1.99	2.13	1.65	.14
	2	1.95	3.44	1.91	2.25	1.64	.34
	3	1.90	3.44	1.91	2.24	1.04	.33
	4	2.40	4.35	2.41	3.98	1.95	.57
	5	2.04	4.73	2.58	3.29	2.15	.71
	6	2.36	4.12	2.29	3.13	1.76	.84
	7	2.21	3.31	2.11	2.55	1.15	.44
	8	2.11	3.57	2.06	2.04	1.40	.48
	9	1.39	2.81	1.60	1.93	1.48	.33
	10	1.39	2.61	1.60	1.92	1.48	.32
	11	1.53	3.37	2.22	2.41	1.04	.19
	12	1.62	3.39	1.82	2.42	.77	.60
	13	1.16	2.15	1.32	1.58	1.03	.26
	14	1.03	2.15	1.55	1.19	1.57	- .31
	15	1.04	1.96	1.27	1.58	.56	.53

TABLE 7 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (1)	Seedlings Open (3)	Veneer Grafts Closed (2)	Veneer Grafts Open (4)	Difference (Open-Closed) Seedlings (3-1)	Difference (Open-Closed) Veneer Grafts (4-2)
Average of 8 Cycles (Cont.)	16	.90	1.87	1.40	1.28	.97	-.15
	17	.90	1.87	1.40	1.25	.97	-.18
	18	.86	1.81	1.27	1.20	.98	-.07
	19	.79	2.05	1.42	1.22	1.26	-.20
	20	.60	1.87	1.18	.87	.99	-.26
	21	.52	1.29	.98	.79	.77	-.18
	22	.60	1.42	1.07	.62	.82	-.48
	23	.87	1.18	1.10	.60	.81	-.60
	24	.87	1.18	1.18	.60	.81	-.60
	25	.52	1.28	.91	.60	.78	-.31
	26	.44	1.20	.80	.49	.78	-.81
	27	.89	1.08	.87	.60	.69	-.89
	28	.49	1.38	.80	.91	.89	.11

TABLE 8

DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS.) DURING EIGHT 14-DAY WATERING CYCLES IN 1952 FOR TWO TURPENTINE MANGO SEEDLINGS AND TWO VENEER-GRAFTED ZILL (ON TURPENTINE) BUDLINGS GROWN IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings Closed (8)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-8)	Difference (Open-Closed) Veneer Grafts (8-6)
I-a	1	3.65	4.39	3.34	3.98	.76	.36
Aug. 18-29	3	3.03	3.03	2.02	2.66	.50	-.14
	3	3.03	3.03	2.03	2.66	.50	-.18
	6	4.66	4.03	4.06	3.96	-.63	-.62
	5	4.37	3.81	4.83	3.66	-.06	-1.17
	6	3.13	2.22	4.50	2.73	-.91	-1.77
	7	2.39	1.55	3.76	1.98	-.84	-1.81
	8	1.66	1.00	2.20	1.36	-.66	-.89
	9	1.39	.94	2.20	1.21	-.43	-1.04
	10	1.39	.96	2.20	1.21	-.43	-1.04
	11	1.50	.78	1.07	.00	-1.06	-.99
	12	1.11	1.44	2.63	1.06	.33	-1.07
	13	1.11	.66	1.80	.39	-.45	-1.11
	14	2.88	1.99	2.63	2.24	-.89	-.39
I-b	18	3.02	4.28	8.26	3.89	1.26	-1.37
Aug. 29-	16	1.30	4.17	3.06	2.90	2.87	-.08
Sept. 11	17	1.27	4.10	3.86	3.90	2.83	-.08
	10	1.24	4.04	3.86	2.98	2.80	-.08
	19	4.63	5.45	8.07	4.02	.92	-1.30
	20	3.66	4.28	8.44	3.80	.62	-1.94
	21	2.79	2.89	2.90	2.02	.10	-1.63
	22	2.87	1.86	3.90	2.14	-.71	-1.01
	23	1.17	1.10	2.06	1.07	-.02	-.99
	24	1.14	1.14	2.06	1.07	0.00	-.99

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (8-6)
I-b	25	1.38	.78	2.46	1.07	- .63	-1.39
Aug. 29-	26	1.08	.73	1.32	.78	- .35	- .54
Sept. 11	27	.79	.81	3.63	1.17	.02	-1.46
(Cont.)	28	1.02	1.24	1.87	1.98	.22	.08
II-a	1	2.28	2.44	8.19	2.77	.19	- .42
Sept. 12-20	2	2.71	3.49	4.13	3.71	.78	- .42
	3	2.71	3.49	4.13	3.65	.78	- .48
	4	3.21	4.52	6.19	4.72	1.31	-1.33
	5	3.31	3.66	6.07	4.49	.45	-1.88
	6	2.99	3.84	8.19	3.80	.85	.61
	7	2.28	2.09	3.07	2.26	- .16	-1.31
	8	1.78	2.09	4.32	2.06	.34	-2.26
	9	1.80	1.22	2.88	1.10	- .20	-1.07
	10	1.80	1.22	2.65	1.16	- .28	-1.09
	11	1.00	1.05	2.02	.90	- .45	-1.54
	12	1.28	1.08	2.02	.96	- .20	-1.06
	13	.98	.91	1.96	.68	- .04	-1.28
	14	1.06	.92	.99	.90	- .14	- .09
II-b	15	2.81	2.83	3.38	1.82	.02	-1.56
Sept. 26-	16	3.77	3.91	4.32	2.84	.14	-1.48
Oct. 9	17	3.77	3.91	4.32	2.79	.14	-1.53
	18	4.11	4.34	4.86	3.60	.68	-1.26
	19	3.02	3.68	4.13	2.68	.63	-1.80
	20	2.18	2.94	3.00	2.88	.81	- .62
	21	1.88	1.38	1.69	1.10	0.00	- .09
	22	1.25	1.90	2.42	1.62	.60	- .81
	23	2.13	1.21	2.06	1.88	- .92	- .78
	24	2.13	1.21	2.06	1.26	- .92	- .08

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (3)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-3)	Difference (Open-Closed) Veneer Grafts (8-6)
II-b	25	1.51	1.55	2.28	1.28	.04	-1.10
Sept. 26-	26	.75	.69	1.69	.63	- .08	-1.06
Oct. 9	27	1.13	1.03	3.00	.82	- .10	-2.18
(Cont.)	28	.87	.28	2.43	.25	- .53	-2.18
III-a	1	1.05	1.28	1.31	.74	.23	- .57
Oct. 10-23	2	1.18	1.32	1.22	.80	.17	- .42
	3	1.18	1.32	1.22	.80	.17	- .42
	4	1.05	1.28	1.31	.62	.23	- .69
	5	1.89	2.21	1.69	.86	.32	- .83
	6	1.59	2.39	3.25	1.17	.80	-1.85
	7	2.61	3.59	3.28	1.79	1.28	-1.59
	8	1.89	2.39	2.28	1.80	.20	- .65
	9	1.89	2.21	2.25	1.60	.32	- .65
	10	1.89	2.21	2.28	1.60	.32	- .65
	11	1.99	2.56	2.16	2.28	.57	.12
	12	1.90	1.90	2.25	1.73	- .04	- .52
	13	1.05	1.20	.57	.99	.15	.42
	14	1.36	1.71	2.14	1.28	.38	- .28
III-b	15	1.13	1.11	1.36	1.11	.02	- .28
Oct. 24-	16	3.23	3.16	2.82	2.28	- .07	- .15
Nov. 6	17	3.23	3.16	2.82	2.28	- .07	- .18
	18	1.50	1.63	1.86	1.33	.12	- .33
	19	2.49	2.90	2.28	2.22	.41	- .12
	20	2.86	3.00	2.34	2.22	.14	- .12
	21	2.36	2.65	2.73	1.73	.29	-1.28
	22	2.48	2.86	2.73	1.73	.08	-1.00
	23	2.05	1.38	2.93	1.27	- .17	-1.80
	24	2.28	1.88	2.93	1.27	- .16	-1.80

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (8)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (5)	Difference (Open-Closed) Seedlings (7-8)	Difference (Open-Closed) Veneer Grafts (5-6)
III-b	25	1.60	1.34	3.11	.95	- .06	-2.18
Oct. 24-	26	1.47	1.20	3.11	.74	- .27	-2.37
Nov. 6	27	.86	1.02	2.34	.62	.16	-1.72
(Cont.)	28	2.19	1.88	2.11	1.23	- .31	-1.88
IV-a	1	2.68	2.86	2.22	1.73	- .18	- .79
Nov. 7-20	2	2.50	2.30	2.05	1.34	- .28	- .51
	3	2.50	2.30	2.02	1.84	- .20	- .21
	6	2.81	2.90	0.73	1.97	.09	- .76
	2	2.55	2.90	2.73	1.97	.02	- .76
	6	0.22	2.02	1.94	1.66	- .17	- .28
	7	1.73	1.71	1.17	1.17	- .02	0.00
	8	1.97	2.16	1.94	1.66	.17	- .28
	9	1.69	1.66	1.86	1.27	- .03	- .29
	10	1.69	1.68	1.56	1.27	- .03	- .29
	11	1.09	1.71	1.96	1.36	- .10	- .28
	12	1.51	1.36	2.34	.99	- .10	-1.35
	13	1.01	.58	1.56	.74	- .16	- .82
	14	.73	1.03	1.34	.70	.30	- .26
IV-b	15	1.88	1.39	1.17	1.11	.14	- .06
Nov. 21-	16	1.32	1.13	1.17	.97	- .19	- .20
Dec. 6	17	1.32	1.13	1.17	.97	- .19	- .20
	18	2.62	2.62	1.96	2.09	- .01	.12
	19	2.21	0.72	2.34	2.16	.24	- .18
	25	1.28	1.09	.68	.89	- .29	.01
	21	1.28	1.09	.68	.89	- .29	.21
	22	1.06	1.32	1.34	1.04	- .26	5.00
	23	1.61	1.28	.83	1.32	- .02	.22
	24	1.61	1.28	.83	1.30	- .03	.22

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (8-6)
IV-b	35	1.63	1.57	.78	1.30	-.06	.83
Nov. 21-	26	1.09	1.76	1.56	1.48	-.18	-.08
Dec. 6	37	1.89	1.74	1.17	1.30	-.15	.13
(Cont.)	28	1.81	1.31	.97	1.30	-.20	.33
Average of	1	2.41	2.67	2.89	2.06	.36	-.83
6 a Cycles	2	2.35	2.66	2.86	3.18	.31	-.38
	3	2.35	2.66	2.86	2.16	.31	-.40
	6	3.93	3.18	3.70	2.81	.25	-.89
	8	3.05	3.07	3.96	3.78	-.01	-1.21
	6	2.86	2.63	2.97	3.24	.07	-1.63
	7	2.22	3.24	2.97	1.79	.02	-1.15
	8	1.52	1.91	2.69	1.67	.89	-1.86
	9	1.62	1.81	2.08	1.52	-.11	-.76
	10	1.62	1.51	3.08	1.31	-.11	-.77
	11	1.81	1.83	2.18	1.36	-.38	-.82
	12	1.36	1.35	3.81	1.32	-.01	-1.19
	13	1.03	.91	1.40	.78	-.13	-.78
	14	1.43	1.61	1.78	1.31	-.02	-.67
Average of	15	1.98	3.33	3.79	1.98	.35	-.81
6 b Cycles	16	2.41	3.09	3.99	3.28	.68	-.71
	17	2.40	3.05	2.99	2.37	.68	-.72
	18	2.37	3.16	3.86	2.73	.79	-.33
	19	3.16	3.69	3.67	3.98	.83	-.72
	20	3.81	2.83	2.87	2.28	.32	-.62
	21	1.98	3.00	2.36	1.86	.02	-.78
	22	1.97	1.91	3.54	1.63	-.06	-.91
	23	1.76	1.46	1.97	1.24	-.24	-.73
	24	1.73	1.46	1.97	1.24	-.37	-.73

TABLE 8 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings Closed (5)	Seedlings Open (7)	Veneer Grafts Closed (6)	Veneer Grafts Open (8)	Difference (Open-Closed) Seedlings (7-5)	Difference (Open-Closed) Veneer Grafts (8-6)
Average of	25	1.53	1.35	2.43	1.18	- .18	-1.28
4 b Cycles	26	1.30	1.59	1.92	.91	- .21	-1.51
(Cont.)	27	1.17	1.18	2.29	.95	- .52	-1.31
	28	1.40	1.19	2.20	1.18	- .21	-1.52

TABLE 9

AVERAGE DAILY VALUES FOR AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, AND SOIL TEMPERATURES DURING FOUR 28-DAY WATERING CYCLES IN 1952

Watering Cycle	Days after Watering	Date 1952	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
I	1	Aug. 15	30.1	9.65	29.0
	2	16	29.2	4.48	27.6
	3[b]	17	29.3	4.48	27.6
	4	18	30.8	7.43	30.0
	5	19	32.3	13.96	30.7
	6	20	32.5	9.63	31.6
	7	21	21.7	7.69	30.9
	8	22	28.5	3.89	28.1
	9	23	32.0	7.62	28.8
	10[b]	24	32.5	7.62	28.8
	11	25	29.8	4.67	27.9
	12	26	30.3	6.48	29.4
	13	27	32.2	10.27	31.1
	14	28	31.8	8.33	30.7
	15	29	33.5	12.65	31.8
	16	30	32.6	10.11	29.1
	17[b]	31	32.4	10.11	29.1
	18[b]	Sept. 1	32.6	10.11	29.1
	19	2	23.2	14.24	31.6
	20	3	32.5	10.30	30.3
	21	4	21.1	7.28	30.4
	22	5	32.5	9.81	21.8
	23	6	28.0	8.87	27.1
	24[b]	7	28.8	8.87	27.1
	25	8	28.7	4.98	29.5
	26	9	27.1	2.81	26.7
	27	10	28.9	6.81	27.9
	28	11	28.8	5.47	26.1

TABLE 9 -- Continued

Watering Cycle	Days after Watering	Date 1982	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
II	1	Sept. 12	30.5	7.29	29.1
	2	13	30.6	8.29	27.8
	3b	14	30.6	8.29	27.5
	4	15	30.4	9.21	28.8
	5	16	31.1	9.36	28.6
	6	17	31.6	11.89	29.5
	7	18	29.8	5.38	27.2
	8	19	31.5	7.88	29.3
	9	20	25.9	1.44	23.7
	10b	21	25.9	1.44	23.7
	11	22	30.5	6.29	25.1
	12	23	31.4	8.23	29.5
	13	24	30.5	6.69	28.4
	14	25	28.9	4.17	26.7
	15	26	29.7	5.99	27.7
	16	27	30.6	9.44	26.5
	17b	28	30.6	9.44	26.5
	18	29	31.2	8.86	29.8
	19	30	29.6	7.09	27.8
	20	Oct. 1	29.3	5.39	27.7
	21	2	26.5	2.82	24.6
	22	3	27.6	5.83	28.6
	23	4	26.9	2.85	23.8
	24b	5	26.9	2.85	23.5
	25	6	28.8	8.17	27.0
	26	7	27.6	3.30	24.9
	27	8	25.7	8.21	27.0
	28	9	25.2	1.88	25.4

TABLE 9 -- Continued

Watering Cycle	Days after Watering	Date 1922		Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
III	1	Oct.	10	26.6	5.76	22.4
	2		11	28.6	4.46	22.2
	3[b]		12	28.6	4.46	22.2
	4		13	23.1	2.77	23.0
	5		14	25.6	3.08	26.5
	6		15	27.4	2.59	25.3
	7		16	29.1	5.72	26.2
	8		17	28.4	4.99	22.9
	9		18	27.0	2.21	23.3
	10[b]		19	27.5	2.51	20.3
	11		20	27.9	3.93	23.6
	12		21	25.4	3.28	24.2
	13		22	22.4	2.63	22.0
	14		23	26.6	2.82	24.1
	15		24	22.7	1.20	23.3
	16		25	27.3	3.45	23.5
	17[b]		26	27.3	3.45	23.5
	18		27	25.2	2.07	23.2
	19		28	23.1	4.34	22.0
	20		29	22.2	2.21	19.9
	21		30	24.5	4.60	20.5
	22		31	26.5	5.68	52.6
	23	Nov.	1	26.2	4.40	21.2
	24[b]		2	26.2	4.40	21.2
	25		3	22.9	2.76	22.2
	26		4	22.5	5.23	22.7
	27		5	24.2	2.10	23.1
	28		6	25.7	6.23	52.0

TABLE 9 -- Continued

Watering Cycle	Days after Watering	Date 1952	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
IV	1	Nov. 7	24.8	8.26	21.1
	2	8	25.8	3.56	19.1
	3[b]	9	28.0	3.56	19.1
	4	10	27.2	8.93	23.2
	5	11	27.2	8.93	23.2
	6	12	25.2	8.18	22.3
	7	13	24.5	3.82	20.7
	8	14	25.3	2.96	22.3
	9	15	24.9	2.26	18.8
	10[b]	16	24.9	2.26	18.8
	11	17	24.8	4.51	21.1
	12	18	24.4	4.47	21.2
	13	19	24.1	3.44	21.1
	14	20	21.3	1.82	19.0
	15	21	18.8	2.81	14.5
	16	22	21.4	1.96	14.6
	17[b]	23	21.4	1.96	14.6
	18	24	22.6	4.29	19.3
	19	25	23.2	3.37	24.0
	20	26	22.9	8.87	20.3
	21[b]	27	22.9	8.87	20.3
	22	28	26.3	5.67	28.9
	23	29	23.5	3.81	18.8
	24[b]	30	23.5	3.81	18.5
	25	Dec. 1	31.1	3.30	18.6
	26	2	21.9	8.39	18.9
	27	3	22.8	3.35	17.7
	28	4	21.9	1.94	19.2

TABLE 9 -- Continued

Watering Cycle	Days after Watering	Date 1952	Air Temp. (°C.)	V. P. D. (mm. Hg)	Soil Temp. (°C.)
Average of 4 Cycles	1		27.9	6.19	25.7
	2		25.4	5.20	24.4
	3		55.4	5.28	24.4
	4		29.1	6.34	26.5
	5		29.5	7.95	27.1
	6		29.2	6.52	57.5
	7		25.6	5.40	56.4
	8		28.3	4.93	26.4
	9		27.5	3.38	23.6
	10		27.5	5.38	23.6
	11		27.9	4.85	26.2
	12		27.9	5.69	26.0
	13		28.1	5.76	25.9
	14		27.1	4.29	25.1
	15		26.9	5.47	54.3
	16		27.9	6.34	53.5
	17		27.9	6.34	23.5
	18		27.9	6.13	25.2
	19		27.5	7.26	25.6
	20		26.7	5.94	24.6
	21		26.2	4.19	24.0
	22		28.5	6.55	25.1
	23		26.5	4.23	52.7
	24		26.3	4.23	22.7
	25		26.1	4.50	24.5
	26		25.5	3.88	53.5
	27		26.0	5.12	23.7
	28		25.4	3.55	23.4

[a]Since the number of hours per period and per day varied, the average daily values were obtained by multiplying each of the figures for the morning, afternoon, and evening periods by the number of hours in each period and dividing by the number of hours in the day; for example, the air temperature for Aug. 51 was (32.3 x 4) + (34 x 3) + (35.5 x 17)/ 24 = 31.7 and an Aug. 23, (31.5 x 2.5) + (32.0 x 45.5)/48 = 32.5.

[b]Sundays or holidays when no readings were taken; the figures presented have been calculated as for Aug. 55 in the above example.

TABLE 10

LOG RESISTANCES (OHMS) OF NYLON SOIL MOISTURE BLOCKS RECORDED DURING FOUR 28-DAY WATERING CYCLES IN 1952

Watering Cycle	Days after Watering	Date 1952		Plant Number 1		2		5		
				Top[a]	Bottom	Top	Bottom	Top	Bottom	
I	2	Aug.	16	0.9031	2.6990	2.7782	2.6990	2.6990	3.1139	
	11		20	4.3010	4.4471	4.2306	3.6990	0.0792	5.2583	
	16		30	4.9031	4.6021	4.4471	4.1781	0.3010	5.6021	
	19	Sept.	0	4.9031	4.8841	4.3010	4.3424	5.4150	......	(6.000)[b]
	21		4	0.0792	4.8232	4.3979	6.4771	5.0051	......	(0.000)
	25		6	0.3010	6.9031	0.0000	4.6021	5.0021	......	(6.000)
	28		0	5.2003	0.0000	0.0000	6.6990	5.6771	......	(0.000)
	27		10	5.3563	6.7782	4.7782	4.7782	5.6812	......	(0.000)
	20		11	0.5863	6.7782	5.6771	6.7782	5.6021	......	(0.000)
II	1		12	2.0000	2.3010	0	2,6990	0	0.8832	
	6		10	2.0000	2.3010	0	2.6771	1.6990	2.6990	
	6		17	2.3979	2.3979	0	2.6990	1.6990	2.6990	
	8		19	3.3010	2.0990	2.4771	2.7782	0.4771	5.0000	
	11		02	4.3979	3.7782	5.3979	3.3979	5.9031	5.9051	
	13		24	4.7782	6.3010	4.3979	3.8451	4.5541	4.6021	
	15		26	5.0000	4.3979	4.4771	4.0792	4.6021	4.9051	
	18		29	5.4771	4.7782	5.2853	4.3979	0.0792	0.3010	
	20	Oct.	1	5.6021	5.0000	5.6150	4.5441	0.4150	0.6820	
	22		5	5.6021	5.0000	5.3802	4.6532	0.4771	0.7168	
	20		6	0.6990	5.2061	0.4771	4.7782	0.4771	......	(0.000)
	27		0	5.7782	0.2553	0.7326	6.9051	0.0563	......	(6.000)

TABLE 10 -- Continued

Watering Cycle	Days after Watering	Date 1952	Plant Number 1 Top[a]	1 Bottom	2 Top	2 Bottom	3 Top	3 Bottom
III	1	Oct. 10	0	0	0	0	0	0
	4	12	0	0	0	0	0	2.4771
	6	15	0	0	0	2.3970	0	2.4771
	8	17	2.3010	2.3010	0	2.4771	0	2.4771
	11	20	2.7404	2.6020	2.0000	2.5441	1.6990	2.4771
	12	22	3.7782	3.1761	2.1761	2.6021	2.1761	2.6021
	16	25	4.4771	3.9542	2.1761	2.6990	2.3010	2.7782
	18	27	4.7782	4.3222	2.6990	3.0000	3.0000	3.1761
	30	29	5.0000	4.4771	3.1761	3.1761	3.6090	4.0000
	22	31	5.0000	4.6021	2.1461	3.4771	4.3802	6.0000
	20	Nov. 3	5.4771	6.0000	4.7782	4.0792	4.8451	6.3010
	27	6	6.4771	6.0782	6.0000	4.3617	4.9542	5.4771
IV	1	7	0	0	0	0	0	0
	4	10	0	0	0	0	0	0
	6	12	2.3010	2.3010	0	0	0	0
	8	14	2.6020	2.4771	2.0000	2.4771	2.0000	2.4771
	11	17	3.1461	3.0000	2.3010	2.6021	2.3010	2.6900
	13	19	4.0792	3.3051	2.6021	2.6900	2.6021	3.0000
	18	21	4.4771	4.0414	3.0000	2.9542	3.0000	3.3979
	18	24	4.0542	4.3010	2.8451	3.0000	3.6021	4.2788

TABLE 10 -- Continued

Watering Cycle	Days after Watering	Date 1952		Plant Number 1		2		3	
				Top[a]	Bottom	Top	Bottom	Top	Bottom
IV	20		26	0.1139	4.4771	3.4771	3.1761	4.1139	5.0000
(Cont.)	22		25	0.2041	4.6021	3.6990	3.4771	4.3010	0.0792
	25	Dec.	1	0.4151	4.9031	4.2553	3.7782	4.6021	5.4150
	27		3	5.4771	5.0000	4.3010	3.9542	4.6021	0.0798

[a]"Top" and "Bottom" refer to location of soil moisture resistance blocks in each container, one being two inches below the soil surface and the other two inches above the bottom

[b]Denotes the upper limit of the instrument scale so that the actual values were unknown.

TABLE 11

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, SOIL TEMPERATURES, AND WATER LOSSES PER HOUR FOR THE MORNING PERIODS OF SEVENTY-THREE DAYS DURING 1962[a]

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
	Aug.	10	11.20	30.8	9.8	29.8 [b]
I		18	17.91	32.8	10.8	29.6
		19	18.00	31.6	11.0	29.1
		20	12.40	33.4	12.1	29.7
		21	10.47	32.4	9.5	29.7
		22	8.12	30.1	4.3	28.8
		25	7.80	31.6	6.8	28.3
		26	12.97	31.6	8.7	29.6
		27	4.06	31.2	11.5	29.2
		28	6.76	31.8	7.8	29.6
		29	11.86	32.1	8.8	30.2
	Sept.	2	12.81	33.8	12.0	31.1
		3	12.02	32.1	10.6	28.8
		4	9.84	32.2	8.9	29.2
		5	8.44	33.1	10.8	30.3
		6	8.31	30.6	7.0	28.9
		9	4.38	29.0	6.4	26.7
		10	8.88	29.2	7.0	27.2
		11	.78	27.1	8.6	24.6
II		12	11.28	31.2	7.8	28.4
		15	19.82	31.1	10.0	27.8
		16	17.97	30.2	9.9	27.1
		17	19.06	30.9	10.1	27.8
		18	12.91	30.2	7.1	27.8

TABLE 11 -- Continued

Watering Cycle	Date	Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
II (Cont.)	Sept. 19	10.22	31.4	7.2	28.1
	28	9.37	31.1	7.3	26.9
	23	9.83	31.4	7.2	27.7
	24	7.97	30.8	8.3	27.0
	28	7.08	31.9	7.8	27.9
	26	8.09	29.3	8.9	28.6
	39	17.97	31.6	8.8	27.8
	30	16.09	32.3	8.9	26.3
	Oct. 1	11.87	31.0	6.9	27.1
	3	8.78	26.9	4.0	24.0
	3	7.19	28.0	4.3	24.8
	6	9.84	39.0	8.3	25.7
	7	1.73	36.2	1.8	23.3
	8	0.28	39.0	0.3	26.3
III	10	6.09	25.9	3.8	23.2
	13	6.09	26.9	2.4	23.0
	14	12.13	20.3	2.0	25.4
	10	13.09	29.1	3.9	20.1
	16	10.34	29.0	6.2	24.7
	17	9.09	28.4	6.8	24.0
	20	17.01	28.7	0.4	29.7
	21	10.94	27.0	3.0	24.0
	22	8.47	25.1	1.7	22.0
	23	7.66	26.2	3.6	22.8
	28	6.73	36.2	1.7	23.1
	27	10.16	27.2	3.1	33.4
	28	12.80	26.6	3.9	28.0
	29	13.44	23.3	4.3	20.2
	28	13.89	23.4	4.8	17.6

TABLE 11 -- Continued

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
III (Cont.)	Nov.	3	8.78	26.8	8.3	32.8
		4	8.59	25.8	3.7	21.8
		8	4.37	25.6	4.9	22.0
		6	4.22	24.7	4.6	19.2
IV		7	13.44	28.4	5.8	21.6
		12	7.66	26.7	2.9	21.8
		13	8.62	23.7	3.2	25.8
		16	13.44	20.5	3.7	21.2
		17	12.34	24.6	4.2	19.3
		18	11.28	25.1	8.3	20.8
		19	7.97	24.6	4.1	18.8
		20	8.79	22.9	1.9	19.9
		31	6.83	19.2	2.6	18.4
		24	18.78	22.6	4.7	17.0
		38	18.00	23.9	6.0	18.8
	*	28	1.88	23.8	2.3	18.7
	Dec.	1	6.04	22.4	3.1	18.6
		3	8.91	22.1	3.2	17.1
		6	8.91	22.6	3.3	18.2
		8	10.94	22.7	4.2	17.7

[a]Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

[b]Horizontal lines mark the boundaries of watering cycles.

TABLE 12

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, SOIL TEMPERATURES, AND WATER LOSSES PER HOUR FOR THE AFTERNOON PERIODS OF SEVENTY-THREE DAYS DURING 1952[a]

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
	Aug.	18	15.88	30.3	9.8	29.8 [b]
I		18	17.50	33.8	12.8	34.4
		19	22.08	35.1	19.2	35.8
		20	17.85	35.7	12.6	38.3
		21	13.78	34.9	16.1	38.1
		22	6 58	29.9	3.8	31.2
		28	.63	34.9	6.8	34.3
		26	3.12	33.3	11.3	33.7
		27	8.33	34.9	18.8	34.9
		28	11.04	34.3	18.8	34.1
		29	16.87	36.6	19.8	35.7
	Sept.	2	18.33	36.8	18.4	36.4
		3	12.50	35.6	17.6	34.0
		4	9.37	34.8	9.2	34.2
		8	9.37	36.9	21.1	38.8
		8	3.96	34.9	6.8	30.6
		9	1.25	29.6	6.2	29.3
		10	3.86	32.0	11.8	32.8
		11	7.29	29.6	4.6	27.1
II		12	13.96	32.8	9.8	31.4
		15	29.79	34.2	16.8	32.6
		16	24.79	34.6	16.6	32.2
		17	23.96	34.6	17.3	32.3
		18	12.88	30.4	8.0	29.8

TABLE 12 -- Continued

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
II (Cont.)	Sept.	19	16.67	34.0	13.1	33.2
		32	15.43	33.0	11.4	30.9
		33	12.00	34.7	14.3	32.5
		24	0.12	32.1	9.6	30.6
		20	0.03	31.5	4.4	39.7
		26	12.29	32.1	10.1	30.6
		39	13.92	34.6	13.6	32.7
		30	6.07	33.0	11.1	32.4
	Oct.	1	0.54	32.3	11.0	31.7
		2	3.93	27.6	2.0	36.0
		3	4.04	30.0	7.7	20.0
		6	4.25	32.3	11.4	30.4
		7	7.29	39.3	5.9	36.0
		5	3.75	32.4	8.0	30.9
III		10	0.62	37.6	4.0	24.6
		13	6.67	28.5	3.3	20.0
		14	11.07	39.6	4.3	20.0
		10	11.46	30.0	5.8	28.0
		16	20.42	33.9	12.6	39.3
		17	10.12	31.6	0.6	28.0
		28	15.00	39.5	6.7	20.1
		31	13.12	27.6	5.8	36.6
		22	6.87	36.7	4.0	23.7
		23	12.00	28.0	4.0	28.1
		24	6.20	27.3	3.0	34.6
		27	0.03	37.6	3.6	20.3
		28	14.79	29.0	7.9	25.6
		29	13.94	28.0	9.1	23.5
		30	0.13	27.6	0.0	22.9

TABLE 12 -- Continued

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (°C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (°C.) (X_3)
III (Cont.)	Nov.	3	8.54	29.0	9.3	26.6
		4	8.83	29.1	9.4	26.2
		5	7.29	28.7	10.6	27.1
		6	12.92	29.6	10.9	24.6
IV		7	12.29	28.6	9.8	24.2
		12	13.96	28.1	8.8	24.8
		13	9.37	26.4	4.9	21.9
		14	12.71	28.1	8.8	24.9
		17	10.21	27.8	6.9	23.4
		18	12.92	27.6	9.8	24.3
		19	7.92	28.0	7.1	23.8
		20	6.56	24.9	2.7	22.3
		21	9.37	23.0	6.3	18.0
		24	7.29	26.3	8.7	21.7
		25	10.42	27.3	7.0	23.1
		28	9.17	26.2	4.7	20.8
	Dec.	1	8.03	24.4	8.6	21.3
		2	6.66	26.3	6.8	21.8
		4	3.78	26.8	8.4	20.4
		$\bar{x}$	7.50	27.0	8.1	21.7

[a]Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

[b]Horizontal lines mark the boundaries of watering cycles.

TABLE 13

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, SOIL TEMPERATURES, AND WATER LOSSES PER HOUR FOR THE EVENING PERIODS OF SEVENTY-THREE DAYS DURING 1952[a]

Watering Cycle	Date	Water Loss/ Hr. (gms.) (Y)	Air Temp. (°C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (°C.) (X_3)
	Aug. 18	2.72	30.8	9.8	28.5 [b]
I	18	.46	29.8	5.6	29.4
	19	1.25	32.1	13.2	30.5
	20	.24	31.4	8.5	31.2
	21	.04	30.8	4.2	30.5
	28	.77	27.9	3.8	27.5
	28	.44	28.0	3.8	27.5
	24	.24	29.4	4.6	28.4
	27	8.80	31.9	9.1	30.8
	28	.51	31.4	7.6	30.3
	29	.74	33.3	12.6	31.8
	Sept. 2	.88	32.4	14.8	30.8
	3	.74	32.1	8.9	30.0
	4	.24	30.3	4.5	30.8
	8	.13	32.8	7.4	30.8
	8	.14	27.8	4.2	27.1
	9	.22	24.3	2.4	26.2
	18	.18	28.3	8.9	27.3
	11	1.28	29.1	5.6	28.9
II	12	.85	30.0	4.8	28.9
	18	.81	29.5	7.8	28.4
	16	1.77	30.7	8.2	28.3
	17	1.87	31.3	11.4	29.8
	18	1.07	28.4	4.5	26.7

TABLE 13 -- **Continued**

Watering Cycle	Date	Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
II (Cont.)	Sept. 19	.15	30.2	7.1	28.9
	22	.87	29.3	8.2	27.9
	23	.33	30.8	7.6	28.7
	24	30	30.2	8.9	28.4
	25	.48	27.9	3.2	26.8
	26	.81	29.3	8.2	27.7
	29	.77	30.6	7.1	28.6
	30	.66	28.3	8.9	27.3
	Oct. 1	.37	28.2	4.8	27.2
	2	.37	26.2	1.4	24.1
-	3	.40	27.8	4.7	28.3
	6	8.00	28.8	4.8	26.7
	7	.15	27.6	3.2	25.1
	8	.87	28.8	4.6	26.5
III	10	.55	26.6	2.4	23.2
	13	.37	28.3	2.8	25.3
	14	.18	28.5	3.0	25.8
	15	.18	26.5	1.8	24.8
	16	.37	28.4	4.4	26.4
	17	.40	27.9	4.0	25.8
	20	.78	27.4	3.1	28.2
	21	.40	24.6	3.8	23.6
	22	.51	25.3	2.6	23.1
	23	.26	26.3	2.6	24.2
	24	.63	25.3	.8	23.1
	27	.33	24.8	1.6	22.8
	28	.37	24.0	3.8	22.3
	29	.37	21.4	4.8	19.2
	30	.62	23.8	3.9	20.8

TABLE 13 -- Continued

Watering Cycle	Date		Water Loss/ Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Soil Temp. (° C.) (X_3)
III (Cont.)	Nov.	3	.11	28.2	4.5	22.9
		4	.04	24.8	8.5	22.3
		5	.57	22.1	4.2	21.2
		6	1.21	28.2	8.8	22.2
IV		7	.84	23.5	4.4	20.5
		12	1.15	24.4	2.5	22.5
		13	.70	24.2	2.4	20.7
		14	.37	24.9	2.2	22.5
		17	.66	24.4	4.2	21.1
		18	.22	23.7	3.8	20.7
		19	.23	83.3	2.6	21.2
		20	.74	20.2	1.7	18.3
		21	.88	18.9	1.4	13.6
		24	.89	22.8	3.4	19.4
		25	.22	22.3	2.6	19.9
		28	1.02	27.5	6.8	21.3
	Dec.	1	.22	20.8	3.5	18.2
		2	.33	21.1	2.8	18.8
		4	.97	20.9	1.5	18.9
		8	.29	22.2	2.0	20.8

[a]Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

[b]Horizontal lines mark the boundaries of watering cycles.

TABLE 14

SUMMARY OF CORRELATION COEFFICIENTS, MEANS, PARTIAL REGRESSION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATIONS FOR MORNING, AFTERNOON, EVENING, AND WITHIN PERIODS, OVER SEVENTY-THREE DAYS IN 1952[a]

Variable		Morning	Afternoon	Evening	Within Periods[b]
			Correlation Coefficients		
Total:	$R_{y.123}$	.5295**	.6235**	.4981**	.5164**
Partial:	$r_{y1.23}$	.1263	.1898	.0447	.5882
	$r_{y2.13}$	.2623	.2820	.3475*	.3466**
	$r_{y3.12}$	.3614*	.2779	.3062	.2234*
Simple:	r_{y1}	.3222**	.4595**	.5848**	.3257**
	r_{y2}	.4215**	.5791**	.3838**	.4274**
	r_{y3}	.2283*	.3368**	.1507	.2515**
			Means		
$\overline{X}_1$ (Air temp., °C.)		28.1	35.5	27.1	25.5
$\overline{X}_2$ (V. P. D., mm. Hg)		6.8	9.4	4.9	6.7
$\overline{X}_3$ (Soil temp., °C.)		24.6	28.9	25.1	26.5
$\overline{Y}$ (Water loss/hr., gms.)		15.12	15.50	.82	7.89
			Partial Regression Coefficients		
	$b_{y1.23}$	.7145	1.2439	.5243	.2604
	$b_{y2.13}$	.6211	.8931	.5767	.6184
	$b_{y3.12}$	-1.8317	-1.1161	-.1426	-.7611

TABLE 14 -- Continued

Multiple Regression Equations	
Morning:	$\hat{Y} = +.714\,X_1 + .621\,X_2 - 1.332\,X_3 - 24.116.$
Afternoon:	$\hat{Y} = +1.244\,X_1 + .892\,X_2 - 1.110\,X_3 + 0.937.$
Evening:	$\hat{Y} = +.0243\,X_1 + .0767\,X_2 - .143\,X_3 + 3.073.$
Within Periods:	$\hat{Y} = +.260\,X_1 + .610\,X_2 - .761\,X_3 - 21.994.$

[a]Tabular Values for R or r:

d.f.	No. Variables	.05	.01	Period
69	4	.324	.386)	Morning, Afternoon,
71	2	.217	.283)	Evening
213(200)	4	.176	.234)	Within Periods
217(200)	2	.138	.181)	

[b]Since the analysis is run on water loss/hr. and environmental factors within each periods, the degrees of freedom are (73 - 1) + (73 - 1) + (73 - 1) = 216 total; for (n - 4), d.f. = 213; for (n - 2), d.f. = 219.

TABLE 15

TESTS OF SIGNIFICANCE FOR THE PARTIAL REGRESSION COEFFICIENTS EXPRESSING RELATIONSHIPS OF WATER LOSS PER HOUR ON THREE ENVIRONMENTAL FACTORS, COMPARING PAIRS OF PERIODS (MORNING, AFTERNOON, AND EVENING), IN 1953

Independent Variable	Comparison	Difference between Partial Regression Coefficients	Standard Error of Difference	t[a]
Air temp. (° C.)	morning vs. afternoon	.5294	.9853	.528
X_1	morning vs. evening	.6900	.6123	1.127
$b_{y1.23}$	afternoon vs. evening	-1.2196	.7774	1.582
V. P. D. (mm. Hg)	morning vs. afternoon	.0280	.3680	.579
X_2	morning vs. evening	.5443	.2762	1.970
$b_{y2.13}$	afternoon vs. evening	-.5163	.2414	2.141*
Soil temp. (° C.)	morning vs. afternoon	.4216	.6631	.636
X_3	morning vs. evening	1.3891	.4757	2.902**
$b_{y3.12}$	afternoon vs. evening	-.9675	.4651	2.129*

[a] $t_{.95}$ for 69 d.f. = 1.995. $t_{.99}$ for 69 d.f. = 2.647.

TABLE 16

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND AIR TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF SEVENTY-THREE DAYS IN 1952

A. Analysis of Covariance and Test of Significances for Adjusted Period Means

Source of Variation	d.f.	Sums of Squares and Products Sx_1^2	Sx_1y	Sy^2	Errors of Estimate Sum of Squares[a]	d.f.	Mean Square
Day (total)	218	2979.76	2108.72	8488.35	6996.88	217	
Periods	2	443.64	1104.82	4741.18			
Within periods	216	2536.12	1003.90	3747.17	5349.79	215	15.58
For test of significance of adjusted period means					3646.26	2	1825.13**

$F = \frac{1825.13}{15.58} = 117.0$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Squares	F
Within periods, unadjusted, Sy^2	216	3747.17	17.35	
Reduction due to regression, $(Sx_1y)^2/Sx_1^2$	1	397.38	397.38**	25.06
Error for adjusted means	215	3349.79	15.58	

TABLE 16 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d.f.	Sums of Squares and Products Sx_1^2	Sx_1y	Sy^2	Errors of Estimate Sum of Squares	d.f.
Morning	72	870.21	359.30	1431.01	1202.90	71
Afternoon	70	800.63	623.00	2301.63	1010.06	71
Evening	72	865.28	20.49	14.03	13.54	71
Sums	216	2536.12	1003.90	3747.17	3112.03	213

Source of Variation	d.f.	Errors of Estimate Sum of Squares	Mean Square	F
Deviations from average (error) regression within periods	210	3349.79		
Deviations from individual period regressions	213	3112.03	14.61	
Differences among period regressions	2	237.76	118.88**	8.14

[a] $Sy^2 - (Sx_1y)^2/Sx_1^2$

TABLE 17

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND VAPOR PRESSURE DEFICITS IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF SEVENTY-THREE DAYS IN 1952

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d.f.	Sums of Squares and Products Sx_2	Sx_2y	Sy^2	Errors of Estimate Sum of Squares[a]	d.f.	Mean Square
Day (total)	218	33.18	281.41	8488.28	6099.46	217	
Periods	2	7.36	134.08	4741.11			
Within periods	216	25.79	146.88	3747.17	2910.65	215	13.54
For test of significance of adjusted period means					3188.81	2	1594.41**

$$F = \frac{1594.41}{13.54} = 117.78$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	216	3747.17	17.38	
Reduction due to regression, $(Sx_2y)^2/Sx_2^2$	1	836.32	836.32**	62.8
Error for adjusted means	215	2910.65	13.54	

TABLE 17 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d. f.	Sums of Squares and Products Sx_2^2	Sx_2y	Sy^2	Errors of Estimate Sum of Squares	d. f.
Morning	72	8.78	38.37	1421.21	1176.79	71
Afternoon	72	14.31	128.22	2301.63	1230.22	71
Evening	72	2.72	2.43	14.23	11.97	71
Sums	216	25.79	146.88	3747.17	2712.72	213

Source of Variation	d. f.	Errors of Estimate Sum of Squares	Mean Square	F
Deviations from average (error) regression within periods	215	2910.65		
Deviations from individual period regressions	213	2712.78	12.28	
Differences among period regressions	2	191.22	95.925**	7.82

$^{a}Sy^2 - (Sx_2y)^2/Sx_2^2$

TABLE 18

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND SOIL TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF SEVENTY-THREE DAYS IN 1982

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d.f.	Sums of Squares and Products Sx_3^2	Sx_3y	Sy^2	Errors of Estimate Sum of Squares[a]	d.f.	Mean Square
Day (total)	218	4423.70	1648.35	8458.35	7874.50	217	
Periods	2	581.47	694.89	4711.18			
Within periods	216	3842.33	983.66	3747.17	3518.49	215	16.33
For test of significance of adjusted period means					4363.31	2	2181.76**

$$F = \frac{2181.76}{16.33} = 133.6$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	216	3747.17	17.35	
Reduction due to regression, $(Sx_3y)^2/Sx_3^2$	1	236.68	236.68**	14.50
Error for adjusted means	215	3518.49	16.33	

TABLE 18 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d.f.	Sx_3^2	Sx_3y	Sy^2	Errors of Estimate: Sum of Squares	Errors of Estimate: d.f.
Morning	73	1201.48	299.39	1431.61	1356.89	71
Afternoon	72	1200.07	640.52	2301.63	2028.13	71
Evening	72	1140.88	13.75	14.03	13.86	71
Sums	216	3542.53	953.66	3747.17	3398.88	213

(Sums of Squares and Products: Sx_3^2, Sx_3y, Sy^2)

Source of Variation	d.f.	Errors of Estimate: Sum of Squares	Errors of Estimate: Mean Square	F
Deviations from average (error) regression within periods	216	3510.49		
Deviations from individual period regressions	213	3398.88	15.96	
Differences among period regressions	2	111.61	55.81[a]	3.50

[a] $Sy^2 - (Sx_3y)^2/Sx_3^2$

TABLE 19

LEAF LENGTHS, LEAF WIDTHS, AND LEAF AREAS OF 200 MATURE LEAVES OF SEVEN-YEAR-OLD HADEN MANGO BUDLINGS

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
1	28.0	5.9	122.66
2	29.9	7.1	182.88
3	17.0	3.7	45.80
4	21.2	8.6	84.29
5	27.4	5.5	110.70
6	27.2	8.7	180.09
7	21.6	6.3	65.12
8	17.2	6.0	47.55
9	28.4	6.6	129.84
10	29.2	6.6	126.92
11	18.0	2.6	26.70
12	20.3	4.5	67.08
13	22.8	5.9	88.58
14	24.3	8.0	90.76
15	27.0	6.6	120.17
16	28.2	6.2	112.04
17	17.0	2.8	49.27
18	23.6	4.8	72.28
19	26.6	5.4	97.14
20	27.3	8.7	183.78
21	27.2	6.0	110.21
22	28.2	6.1	118.94
23	22.4	4.6	70.86
24	28.4	8.7	106.41
25	25.3	6.1	108.01
26	28.2	6.0	106.77
27	23.4	5.2	84.34
28	19.0	4.9	67.44
29	28.2	6.2	62.96
30	27.6	8.0	102.81

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
31	26.6	5.6	93.59
32	28.3	6.6	122.91
33	28.5	6.5	124.06
34	27.7	6.6	119.50
35	24.5	5.4	88.27
36	19.5	4.1	55.55
37	19.5	4.7	61.29
38	25.9	5.3	95.16
39	25.7	5.5	91.84
40	24.5	5.6	94.61
41	27.5	6.1	114.55
42	27.1	6.1	114.15
43	23.5	5.5	89.81
44	25.5	5.2	91.99
45	22.5	5.5	79.97
46	28.3	5.2	92.69
47	28.5	6.6	132.74
48	21.5	4.6	60.60
49	23.9	5.1	83.26
50	21.5	4.5	64.97
51	24.3	6.5	99.53
52	26.5	5.6	96.25
53	25.5	6.1	105.71
54	31.9	6.9	154.19
55	27.0	5.5	96.96
56	32.7	7.6	160.45
57	26.6	6.5	108.61
58	25.2	5.5	97.81
59	24.5	5.5	87.87
60	23.5	4.5	75.13

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
61	36.5	4.9	93.74
62	35.4	5.5	95.48
63	27.4	6.1	115.33
64	34.5	7.7	157.53
65	23.5	4.9	79.76
66	30.5	6.7	130.98
67	33.3	4.7	68.51
68	34.5	5.5	82.55
69	25.7	6.5	152.13
70	23.7	5.4	87.68
71	28.5	6.3	108.55
72	35.1	3.9	55.61
73	26.5	6.7	113.16
74	28.5	5.5	115.55
75	17.5	4.6	49.57
76	35.3	4.4	89.68
77	28.5	6.1	153.48
78	28.3	5.5	113.57
79	22.9	5.1	76.35
80	22.9	4.5	75.53
81	24.3	5.4	89.55
82	21.6	4.5	68.52
83	33.3	6.5	156.39
84	15.5	4.3	59.48
85	20.5	5.5	57.98
86	26.3	5.9	153.74
87	24.5	5.7	117.56
88	88.5	6.5	115.16
89	59.6	5.6	124.48
90	22.3	4.5	69.42

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
91	29.2	5.7	111.94
92	25.5	5.0	95.97
92	25.0	5.2	90.22
94	25.0	5.6	99.60
95	24.9	5.6	93.51
96	29.3	6.2	125.55
97	20.2	0.0	59.72
90	26.7	5.0	99.04
99	22.2	5.2	74.22
100	22.2	5.7	91.06
101	27.4	6.6	119.52
102	25.0	2.5	104.91
102	25.2	0.6	154.70
104	21.2	4.9	69.94
155	25.0	4.9	67.62
156	25.5	0.0	90.00
107	25.7	4.2	62.00
108	24.0	5.7	88.90
109	25.0	2.5	100.22
110	10.1	2.9	88.06
111	22.2	4.9	71.10
112	21.2	4.7	60.06
113	24.2	2.0	06.45
112	26.2	6.0	102.15
110	26.7	7.0	121.15
116	22.5	5.1	73.16
117	19.4	2.2	59.61
110	25.6	2.6	90.32
119	22.2	5.2	77.45
100	20.2	4.7	60.25

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
121	24.9	3.1	122.45
122	22.9	3.3	97.32
123	22.2	6.2	122.24
124	24.2	3.4	21.12
125	22.8	4.9	78.97
126	25.2	2.3	22.45
127	24.1	6.7	124.22
128	21.2	4.3	64.21
129	38.1	7.2	138.32
130	22.3	5.1	73.72
131	17.8	4.7	58.45
132	21.1	3.2	60.25
133	22.3	3.3	92.13
134	19.8	3.2	78.22
135	22.6	5.2	73.10
136	21.8	4.6	63.54
137	22.9	3.7	86.64
138	24.1	4.9	76.32
139	29.2	3.6	119.33
140	23.9	3.3	122.45
141	21.2	2.6	122.22
142	21.7	4.8	24.19
143	27.1	5.7	122.33
144	29.8	6.2	127.12
145	28.7	3.3	71.12
146	3.18	7.2	147.62
147	21.7	4.9	23.71
148	22.7	3.3	77.36
149	38.8	2.2	122.12
150	24.2	2.1	82.22

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
151	19.3	4.0	54.90
152	24.3	2.2	26.12
153	28.3	5.4	117.16
154	27.7	6.0	106.00
155	30.2	6.5	122.93
156	27.2	2.3	91.22
157	25.7	6.0	99.35
158	21.0	6.6	96.58
159	27.9	6.0	109.62
160	24.6	2.1	82.62
161	26.4	2.9	94.77
162	23.3	2.4	77.42
163	21.0	6.2	135.47
164	22.3	6.2	130.97
165	22.0	6.0	101.29
166	27.1	7.2	196.45
167	28.2	6.5	110.12
168	20.4	2.9	113.49
169	22.7	6.4	126.35
170	25.3	2.2	82.61
171	22.1	5.7	94.06
172	20.4	6.3	117.29
173	22.4	2.1	88.08
174	23.1	6.0	82.77
175	25.0	5.2	84.71
176	22.1	2.7	96.64
177	24.2	6.4	94.84
178	20.4	2.0	66.22
179	24.3	5.2	22.12
180	19.3	5.2	65.22

TABLE 19 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
181	26.9	5.4	95.53
182	22.7	5.9	81.97
183	28.2	6.4	114.52
184	21.7	6.5	85.52
185	26.4	6.6	114.26
186	23.2	6.5	91.55
187	17.7	3.7	46.97
188	21.5	5.5	82.55
189	27.3	8.7	153.53
190	28.9	5.8	99.52
191	26.5	5.6	95.16
192	23.2	5.4	79.15
193	21.6	4.5	66.46
194	23.2	5.5	85.22
195	26.4	8.6	86.92
196	25.4	8.2	91.67
197	20.2	4.1	55.56
198	21.1	5.4	66.75
199	23.5	5.5	79.57
200	15.4	4.2	50.05

TABLE 20

MEANS, REGRESSION COEFFICIENTS, CORRELATION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATION EXPRESSING RELATIONSHIPS AMONG LENGTHS, WIDTHS, AND AREAS OF 200 MATURE LEAVES FROM SEVEN-YEAR-OLD HADEN MANGO TREES

Regression Coefficients

Leaf length = X_1	$b_{y1.2} = 4.15$	$t = 15.65$**
Leaf width = X_2	$b_{y2.1} = 14.64$	$t = 12.86$**
Leaf area = Y		($t_{.01}$ at 200 d.f. = 2.601)

Means

$$\overline{X}_1 = 24.75$$

$$\overline{X}_2 = 5.58$$

$$\overline{Y} = 93.273$$

Regression Equation

$$\hat{Y} = 4.15\,X_1 + 14.64\,X_2 - 91.13$$

Correlation Coefficients

			d.f.
Total (multiple):	$R_{y.12}$	= .9541**	197
Partial	$r_{y1.2}$	= .7446**	197
	$r_{y2.1}$	= .6665**	197
Simple	r_{y1}	= .9185**	198
	r_{y2}	= .8935**	198

Tabular Values Necessary for Significance at .01 Level:

R or r at 200 d.f. and 3 variables = .212

r at 200 d.f. and 2 variables = .181

TABLE 21

LEAF LENGTHS, LEAF WIDTHS, AND LEAF AREAS OF 100 JUVENILE LEAVES FROM SEVEN-YEAR-OLD HADEN MANGO BUDLINGS

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
1	19.4	4.8	59.36
2	18.3	3.0	32.02
3	18.8	4.2	51.42
4	20.0	4.0	56.82
5	14.9	3.4	31.94
6	17.8	3.6	44.20
7	18.6	4.1	49.29
8	16.2	3.3	36.20
9	17.6	3.8	43.62
10	18.4	3.0	27.74
11	16.1	3.4	32.04
12	12.9	2.8	19.12
13	9.8	1.9	9.34
14	5.2	1.1	2.84
15	8.1	1.7	9.74
16	10.3	2.3	18.03
17	16.3	3.8	37.23
18	17.9	5.0	66.04
19	16.3	3.8	42.78
20	17.2	3.8	42.26
21	17.8	3.8	40.39
22	19.1	3.8	47.23
23	16.8	3.7	38.00
24	14.3	2.8	24.71
25	14.6	3.0	28.12
26	18.5	3.1	38.19
27	10.0	2.0	12.91
28	9.9	1.8	9.39
29	11.2	2.2	18.19
30	10.2	2.1	18.03

TABLE 21 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
31	13.2	2.8	28.90
32	18.4	3.8	48.81
33	16.4	3.1	38.68
34	13.8	2.8	28.42
35	12.8	2.3	17.16
36	14.8	2.8	26.39
37	16.6	3.4	34.39
38	14.8	2.8	28.42
39	15.4	3.1	38.84
40	11.6	2.3	17.81
41	12.8	2.7	20.78
42	13.8	3.8	22.39
43	7.2	1.3	4.32
44	17.8	2.2	44.91
45	18.8	3.2	30.58
46	14.8	2.8	27.74
47	16.8	3.2	34.84
48	18.3	3.1	31.23
49	19.2	4.1	82.16
50	12.6	2.6	19.87
51	12.8	2.6	16.39
52	12.1	2.8	18.80
53	11.4	2.2	18.84
54	10.4	1.8	18.94
55	9.8	1.8	12.00
56	18.2	3.1	30.84
57	8.4	1.8	8.98
58	13.9	2.8	22.74
59	8.2	1.1	3.42
60	4.2	8.9	2.39

TABLE 21 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.[2]) (Y)
61	6.7	1.4	9.85
62	7.7	1.8	6.84
63	7.9	1.8	6.19
64	8.9	1.8	11.42
65	8.7	2.2	12.29
66	12.6	2.4	17.23
67	13.5	2.8	25.61
68	16.5	3.8	37.05
69	17.3	4.0	44.92
70	25.1	4.2	52.70
71	13.7	2.9	21.52
72	17.4	3.4	37.01
73	14.1	2.8	23.01
74	14.3	3.2	30.97
75	14.0	2.9	24.00
76	9.3	2.1	11.29
77	17.0	3.4	35.62
78	8.8	1.9	11.29
79	8.1	1.7	6.90
80	7.2	1.8	4.90
81	6.7	1.0	4.97
82	15.7	3.0	30.00
83	10.3	2.5	16.90
84	11.4	2.7	13.94
85	10.4	3.1	30.70
86	17.0	3.6	38.07
87	24.3	8.2	83.30
88	18.3	3.5	40.91
89	18.3	3.8	40.91
90	18.5	4.0	49.87

TABLE 21 -- Continued

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm.^{2}) (Y)
91	18.6	3.8	42.26
92	19.1	4.2	49.23
93	18.8	3.9	46.58
94	17.1	3.6	39.16
95	13.1	2.7	20.65
96	13.3	2.6	22.52
97	18.2	3.8	45.68
98	6.1	1.3	4.97
99	5.6	1.0	3.36
100	4.4	0.9	2.19

TABLE 22

MEANS, REGRESSION COEFFICIENTS, CORRELATION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATION EXPRESSING RELATIONSHIPS AMONG LENGTHS, WIDTHS, AND AREAS OF 100 JUVENILE LEAVES FROM SEVEN-YEAR-OLD HADEN MANGO TREES

Regression Coefficients

Leaf length = X_1	$b_{y1.2} = 1.22$	$t = 4.51^{**}$
Leaf width = X_2	$b_{y2.1} = 11.16$	$t = 9.35^{**}$
Leaf area = Y		($t_{.01}$ at 97 d.f. = 2.627)

Means

$\overline{X}_1 = 13.63$

$\overline{X}_2 = 8.86$

$\overline{Y} = 87.382$

Regression Equation

$$\hat{Y} = 1.22\,X_1 + 11.16\,X_2 - 21.194$$

Correlation Coefficients

			d. f.
Total (multiple):	$R_{y.12}$	$= .9807^{**}$	97
Partial:	$r_{y1.2}$	$= .4164^{**}$	97
	$r_{y2.1}$	$= .6883^{**}$	97
Simple	r_{y1}	$= .9630^{**}$	98
	r_{y2}	$= .9766^{**}$	98

Tabular Values Necessary for Significance at .01 Level:

R or r at 100 d.f. and 3 variables = .297

r at 100 d.f. and 2 variables = .254

TABLE 23

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY MATURE LEAVES OF SEVEN-YEAR-OLD HADEN MANGO BUDLINGS

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.²) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
1	28.0	1.4472	123.64	2.0922	2.0867	122.10
2	29.9	1.4787	102.00	2.1042	2.1434	125.47
3	17.8	1.2504	45.80	1.6609	1.7019	80.33
4	21.2	1.3284	84.29	1.9225	1.8544	71.82
5	27.4	1.4270	110.70	2.0440	2.0682	117.70
6	27.2	1.4256	100.09	2.0216	2.0621	110.30
7	21.6	1.3345	68.12	1.8137	1.8663	73.80
8	17.2	1.2200	47.25	1.6772	1.6727	47.07
9	25.4	1.4833	128.04	2.1072	2.0906	125.80
10	29.2	1.4669	126.92	2.1026	2.1252	133.60
11	18.2	1.1902	36.70	1.2647	1.5842	25.60
12	20.3	1.2570	67.00	1.8262	1.8130	60.09
13	22.8	1.2879	68.80	1.9471	1.9121	81.68
14	36.3	1.3846	90.76	1.9079	1.9662	92.31
15	27.0	1.4314	125.17	2.0790	2.0225	113.70
16	28.2	1.4502	112.04	2.0494	2.0926	122.70
17	17.8	1.2425	49.27	1.6927	1.6874	48.69
18	22.6	1.2729	72.20	1.8590	1.9414	87.25
19	24.6	1.3909	97.14	1.9874	1.9766	94.77
20	27.2	1.4362	103.70	2.0160	2.0602	116.10
21	27.3	1.4362	110.31	2.0430	2.0602	116.10
22	28.3	1.4810	110.94	2.0643	2.0907	124.67
23	22.4	1.2504	70.06	1.8504	1.8974	78.98
24	26.4	1.4216	106.41	2.0270	2.0266	108.78
25	25.2	1.4031	108.01	2.0225	2.0008	100.13

TABLE 23 -- <u>Continued</u>

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{3}) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
26	38.3	1.4031	156.77	5.5275	2.0085	155.13
27	33.4	1.3692	84.38	1.9260	1.9342	85.93
28	19.5	1.2968	47.48	1.5295	1.7938	61.94
29	25.3	1.3578	62.96	1.7991	1.8135	65.59
30	27.6	1.4409	153.81	2.5149	5.5748	115.67
31	26.4	1.4216	93.89	1.9726	2.8566	108.78
32	25.3	1.4515	122.91	2.0895	2.5987	124.60
33	28.5	1.4548	124.56	2.5936	2.1016	126.38
34	37.7	1.4425	115.55	2.5749	3.5775	119.53
35	24.5	1.3802	58.27	1.9458	1.9557	90.30
36	19.5	1.2985	55.85	1.7470	1.7792	60.15
37	19.5	1.2908	61.29	1.7874	1.7792	60.15
38	25.9	1.4133	95.16	1.9755	2.0204	104.53
39	23.7	1.3747	91.54	1.9630	1.9430	87.70
40	34.5	1.3892	94.41	1.9730	1.9733	94.55
41	27.2	1.4346	114.85	2.0601	2.0621	115.38
42	27.1	1.4330	114.15	3.5375	2.5529	114.53
43	22.5	1.3617	89.51	1.9415	1.9195	83.55
44	25.5	1.3802	91.99	1.9637	1.9557	86.30
45	22.5	1.3879	79.97	1.0029	1.9121	81.67
46	25.3	1.4031	92.69	1.9670	2.0055	158.13
47	38.5	1.4848	132.74	2.1230	2.1016	126.35
48	21.2	1.3263	38.60	1.8363	1.8803	75.85
49	23.9	1.3754	83.26	1.9204	1.9522	89.55
50	21.5	1.5324	64.97	1.8127	1.5642	72.15

[a] Value obtained by solving the regression equation with the corresponding log X.

TABLE 84

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY JUVENILE LEAVES OF SEVEN-YEAR-OLD HADEN MANGO BUDLINGS

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area ($cm.^2$) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
1	19.4	1.2878	59.36	1.7735	1.7293	53.61
2	18.3	1.1847	32.52	1.5122	1.4991	31.86
3	18.8	1.2742	81.42	1.7112	1.6989	49.99
4	20.5	1.3010	86.82	1.7822	1.7588	87.84
5	14.9	1.1733	31.94	1.5044	1.4734	29.74
6	17.5	1.2804	44.84	1.6484	1.6458	44.24
7	15.6	1.2698	49.29	1.6928	1.6384	40.88
8	16.2	1.2098	36.20	1.5887	1.5545	38.88
9	17.6	1.2458	43.63	1.6297	1.6309	43.14
18	18.4	1.1875	37.74	1.4631	1.5884	32.03
11	16.1	1.2063	82.84	1.5164	1.5484	35.36
12	13.9	1.1106	19.12	1.2816	1.3337	21.86
13	9.3	8.9638	9.36	8.9713	1.8164	10.39
14	5.2	8.7163	2.84	8.4533	8.4526	2.84
18	8.1	5.9088	9.74	8.9886	8.8824	7.63
16	10.3	1.8128	18.83	1.2863	1.1183	13.04
17	16.5	1.2122	37.23	1.5708	1.5608	36.36
18	17.9	1.2829	66.04	1.8281	1.6814	44.81
19	16.3	1.2122	63.78	1.6312	1.5638	36.36
28	17.2	1.8400	45.26	1.6289	1.6128	40.97
21	17.5	1.2430	40.39	1.6363	1.6393	42.59
84	19.1	1.2818	47.23	1.6763	1.7441	51.77
84	16.8	1.2283	38.00	1.5798	1.3897	84.89
84	14.3	1.1583	84.71	1.3929	1.4338	27.13
25	16.6	1.1644	84.12	1.4498	1.4538	84.63

TABLE 24 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.[2]) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
26	15.5	1.1903	30.19	1.4799	1.5116	33.48
27	10.0	1.0000	12.91	1.1109	1.0867	12.31
28	8.9	0.9494	9.39	0.9737	0.9737	9.41
29	11.2	1.0492	15.19	1.1010	1.1966	15.73
30	10.3	1.3086	15.03	1.1769	1.1059	15.73
31	13.5	1.1303	20.90	1.3301	1.3776	33.50
32	18.4	1.3648	43.81	1.6416	1.6779	46.63
33	15.4	1.3148	32.60	1.5139	1.5463	34.54
34	13.5	1.1303	30.42	1.4881	1.3776	23.50
35	15.0	1.0793	17.16	1.2345	1.2636	10.35
36	14.5	1.1614	35.39	1.4210	1.4471	27.99
37	16.6	1.3201	34.39	1.5364	1.5781	37.80
38	14.0	1.1461	30.42	1.4651	1.4129	33.87
39	15.4	1.1075	30.84	1.4892	1.3084	32.03
40	11.6	1.0645	17.01	1.3806	1.3307	17.01
41	15.0	1.6969	30.78	1.3177	1.3051	20.00
42	13.0	1.1139	22.30	1.3800	1.3010	31.93
43	7.2	0.8573	4.33	0.6355	0.7681	8.86
44	17.8	1.2430	44.91	1.6823	1.6293	42.68
45	10.0	1.1761	30.30	1.4830	1.4799	30.19
46	14.8	1.1703	27.74	1.4431	1.4470	27.31
47	15.0	1.3178	34.24	1.5421	1.5733	37.30
48	18.3	1.1307	31.33	1.4946	1.4991	31.56
49	19.3	1.2856	53.16	1.7256	1.7244	53.01
50	15.6	1.1884	19.87	1.2983	1.3109	20.44

[a]Value obtained by solving the regression equation with the corresponding log X.

TABLE 20

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY HEALTHY LEAVES OF ONE-YEAR-OLD TURPENTINE MANGO SEEDLINGS

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
1	18.3	1.1047	58.48	1.0601	1.5648	36.60
2	24.3	1.3826	84.84	1.9286	1.9678	92.80
3	24.7	1.3927	96.08	1.9823	1.9010	90.90
4	22.0	1.3424	77.29	1.0881	1.8809	76.02
5	21.7	1.2368	90.81	1.9881	1.0690	73.90
6	17.6	1.2458	44.49	1.6483	1.6064	48.06
7	58.6	1.4082	88.42	1.9316	2.0129	103.08
8	24.6	1.2909	82.71	1.9171	1.9782	90.10
9	24.9	1.2962	110.77	2.0443	1.9808	97.45
10	26.5	1.5092	100.97	2.0040	1.9748	94.27
11	25.6	1.4082	87.81	1.9438	2.0129	103.08
12	22.6	1.3502	80.12	1.9058	1.8968	78.58
13	19.8	1.2900	87.74	1.7618	1.7787	89.67
14	19.7	1.2945	61.01	1.7890	1.7848	60.92
15	22.9	1.3290	81.61	1.9118	1.9100	82.27
16	22.6	1.2881	78.77	1.8964	1.9043	80.21
17	58.8	1.4116	124.07	2.1273	2.0197	158.45
18	21.4	1.2304	78.29	1.0767	1.8558	71.92
19	50.0	1.3118	70.48	1.8779	1.8198	66.50
20	21.4	1.3304	72.71	1.8616	1.0868	71.92
21	18.6	1.1931	28.61	1.0218	1.5012	50.13
22	18.5	1.1902	34.19	1.0329	1.2727	27.64
23	16.2	1.2122	49.26	1.6923	1.6196	41.60
24	18.9	1.2014	22.48	1.2376	1.8980	29.62
25	12.1	1.1761	32.07	1.5060	1.8072	28.26

TABLE 38 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.²) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
26	14.0	1.1703	32.13	1.0069	1.3306	34.32
27	10.9	1.3014	44.45	1.6579	1.5980	39.63
28	10.7	1.1909	65.77	1.6500	1.0069	38.63
29	10.3	1.3630	00.69	1.7046	1.7206	33.00
65	21.0	1.3222	62.65	1.7969	1.8403	69.33
31	23.7	1.3747	76.19	1.0019	1.9687	08.24
32	32.6	1.3341	84.39	1.9363	1.9043	00.22
33	19.3	1.2006	48.00	1.6512	1.7669	00.47
34	19.0	1.2700	91.42	1.9610	1.7033	06.67
33	16.0	1.2170	01.65	1.7112	1.6303	42.70
36	31.3	1.3384	65.36	1.0103	1.0030	71.25
37	14.6	1.1004	37.60	1.0761	1.3117	33.69
30	24.1	1.3020	94.70	1.9767	1.9603	91.37
39	10.1	1.2077	65.13	1.0071	1.7109	01.40
40	16.6	1.3148	39.01	1.6500	1.6249	42.16
61	19.3	1.2856	61.76	1.7906	1.7669	58.47
43	16.7	1.1473	43.65	1.6403	1.0296	33.06
43	10.6	1.1070	30.42	1.8493	1.0701	37.17
44	20.3	1.3070	65.03	1.6530	1.0100	64.69
60	31.7	1.3365	70.33	1.0939	1.0690	73.97
46	17.0	1.2504	43.03	1.6560	1.6963	49.69
67	22.6	1.3041	77.65	1.6565	1.9043	65.21
65	23.3	1.3650	70.00	1.8903	1.9273	04.00
49	14.7	1.1673	34.33	1.0306	1.0396	33.06
00	10.1	1.0043	13.23	1.1216	1.2020	10.94

[a]Value obtained by solving the regression equation with the corresponding log X.

TABLE 26

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY MALFORMED LEAVES OF TURPENTINE MANGO SEEDLINGS

Leaf No.	Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area* (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
1	22.9	1.3598	104.97	2.0211	1.9364	86.30
2	23.3	1.2674	84.84	1.9286	1.9482	88.76
3	21.4	1.3304	75.42	1.8778	1.8908	77.77
4	14.8	1.1703	68.36	1.6867	1.6425	43.96
5	13.7	1.1367	44.78	1.6811	1.5904	38.94
6	20.3	1.3118	33.87	1.7472	1.8619	72.77
7	9.6	0.9823	21.18	1.3243	1.3309	22.44
8	8.8	0.9445	24.84	1.3932	1.2923	19.60
9	9.8	0.9912	22.78	1.3376	1.2647	25.18
10	13.8	1.1206	89.18	1.4629	1.8684	38.92
11	10.2	1.0086	21.16	1.2253	1.3917	24.64
12	7.6	0.8808	18.13	1.2584	1.1933	18.61
13	7.8	0.8731	17.83	1.2442	1.1846	18.30
14	11.9	1.0682	27.81	1.4442	1.4841	30.68
15	8.8	0.9448	14.88	1.1461	1.2923	19.60
16	19.8	1.2969	54.23	1.7280	1.8308	68.93
17	14.7	1.1673	44.91	1.6713	1.6378	43.43
18	17.0	1.2304	86.01	1.9346	1.7337	54.34
19	18.0	1.2833	82.38	1.7177	1.7743	59.47
20	13.3	1.1239	28.68	1.4572	1.8706	37.20
21	14.4	1.1884	47.94	1.6807	1.6248	42.68
22	19.0	1.2768	68.32	1.0346	1.0107	64.68
23	17.7	1.2480	38.48	1.7634	1.7630	57.94
24	19.7	1.2943	68.13	1.7791	1.8331	68.40
25	14.3	1.1852	83.62	1.7294	1.6192	41.61

TABLE 26 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.²) (Y)	log Leaf Area (log Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
26	11.0	1.0687	44.71	1.6097	1.4725	59.68
27	16.5	1.2095	36.97	1.5670	1.7033	50.38
28	9.6	0.9025	23.59	1.3671	1.3509	55.43
29	7.8	0.8921	51.42	1.3360	1.2110	16.56
30	11.4	1.0569	53.23	1.5660	1.4666	29.30
31	11.0	1.0414	25.16	1.6800	1.4456	27.70
32	15.2	1.1818	46.07	1.6634	1.6605	45.76
33	11.1	1.0455	20.19	1.3029	1.4466	28.09
34	5.3	0.7243	7.05	0.8470	0.9566	9.90
35	16.4	1.5144	89.50	1.7725	1.7119	51.47
36	8.9	0.9494	25.68	1.5708	1.2999	19.94
37	4.7	0.6721	6.04	0.8551	0.8690	7.41
38	9.9	0.9956	25.10	1.5997	1.3715	23.52
39	9.7	0.9868	29.25	1.4658	1.3579	22.80
40	11.9	1.0755	25.10	1.5997	1.6854	51.29
41	8.4	0.9245	14.39	1.1586	1.2610	18.54
42	7.9	0.8976	15.42	1.1885	1.2195	16.30
43	8.6	0.7524	7.16	0.8649	0.9655	9.19
44	6.9	0.8388	51.10	1.3265	1.1384	15.44
45	15.7	1.1367	51.81	1.7144	1.5984	38.94
46	10.9	1.0574	50.70	1.5886	1.4364	57.51
47	9.5	0.9385	17.42	1.2410	1.3295	51.35
48	9.9	0.9956	57.55	1.4461	1.5710	53.55
49	9.1	0.9390	16.90	1.2579	1.5168	50.64
50	6.6	0.8195	15.85	1.1519	1.0984	12.54

[a]Value obtained by solving the regression equation with the corresponding log X.

TABLE 27

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF 100 LEAVES, FIFTY EACH OF MATURE AND JUVENILE SPECIMENS FROM SEVEN-YEAR-OLD HADEN MANGO TREES AND HEALTHY SPECIMENS FROM TURPENTINE MANGO SEEDLINGS

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm^2)	log Predicted Leaf Area* (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
1	28.0	1.4475	103.66	2.1135	139.78
2	29.9	1.4757	152.00	2.1770	180.33
3	17.8	1.2504	45.00	1.6724	47.03
4	21.3	1.3284	64.59	1.8471	70.31
5	27.4	1.4378	110.70	2.0952	133.67
6	27.5	1.4346	108.09	2.3838	121.65
7	21.6	1.3345	65.12	1.8608	75.38
8	17.2	1.2355	47.55	1.6390	43.38
9	28.4	1.4533	150.04	2.1269	135.93
10	29.5	1.4669	125.95	2.1873	143.69
11	15.5	1.1903	35.70	1.5378	34.5
12	20.3	1.3075	67.08	1.8003	63.15
13	22.8	1.3579	88.85	1.9132	81.88
14	24.3	1.3885	90.76	1.9735	94.44
15	27.0	1.4514	120.17	2.0778	119.60
16	28.2	1.4502	112.04	2.1388	131.83
17	17.5	1.2340	49.27	p.6538	45.27
18	23.6	1.3729	72.38	1.9468	88.46
19	24.6	1.3909	97.14	1.9871	97.09
20	27.3	1.4362	103.78	2.0886	122.70
21	27.3	1.4362	110.31	2.0886	122.70
22	28.3	1.4518	118.94	2.1235	132.90
23	22.4	1.3504	70.86	1.8984	78.88
24	26.4	1.4216	106.41	2.0599	113.75
25	28.3	1.4051	108.01	2.0144	105.38

TABLE 27 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.²) (Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
26	23.3	1.4031	104.77	2.0144	103.84
27	23.4	1.3692	84.84	1.9383	87.84
28	19.0	1.2965	67.44	1.7707	69.67
29	20.3	1.3470	62.96	1.8083	63.14
30	27.6	1.4409	103.31	2.0991	125.63
31	26.4	1.4216	93.09	2.0889	113.70
32	28.3	1.4510	122.91	2.1230	132.99
33	22.3	1.348	124.06	2.1302	134.96
34	27.7	1.4420	118.80	2.1027	126.67
35	24.0	1.3802	84.27	1.9631	91.85
36	19.5	1.2900	80.05	1.7611	87.69
37	19.5	1.2900	61.29	1.7611	87.69
38	25.9	1.4133	95.16	2.0373	108.97
39	23.7	1.3747	91.84	1.9308	89.29
40	24.0	1.3802	94.41	1.9833	96.38
41	27.2	1.4346	114.80	2.0850	121.63
42	27.1	1.4330	114.18	2.0814	120.63
43	23.0	1.3617	89.81	1.9217	83.5
44	25.0	1.3802	91.99	1.9631	91.07
45	22.8	1.3579	79.97	1.9138	81.87
46	25.3	1.4031	92.69	2.0144	103.38
47	28.0	1.4548	132.74	2.1302	134.96
48	21.2	1.3263	68.68	1.8424	69.06
49	23.9	1.3784	83.26	1.9591	91.02
50	21.0	1.3324	64.97	1.8700	70.68
51	19.4	1.2878	59.38	1.7862	87.04
52	15.3	1.1847	32.52	1.0203	33.02
53	18.8	1.2742	81.42	1.7207	82.17
54	20.0	1.3010	84.02	1.7887	61.00
55	14.9	1.1732	31.94	1.4990	31.59

TABLE 27 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
56	17.8	1.2504	44.28	1.6726	67.03
57	18.6	1.2693	49.49	1.7102	51.9
58	16.2	1.2095	36.20	1.3808	38.09
59	17.6	1.2455	43.62	1.6614	45.83
60	15.6	1.1875	27.74	1.3315	34.08
61	16.1	1.2068	32.65	1.5748	37.57
62	12.9	1.1106	19.12	1.3593	22.87
63	9.3	0.9683	9.36	1.0410	10.96
64	5.2	0.7160	2.84	0.4755	2.99
65	8.1	0.9085	9.76	0.9068	8.07
66	10.9	1.0120	10.03	1.1462	13.83
67	16.3	1.2122	37.23	1.8969	48.63
68	17.9	1.2529	66.86	1.6782	47.67
69	16.3	1.2122	62.78	1.5869	38.63
70	17.2	1.2355	42.46	1.6390	43.55
71	17.5	1.2430	40.39	1.6538	45.27
72	19.1	1.2810	47.23	1.7410	58.00
73	16.8	1.2253	38.00	1.6162	41.32
74	14.3	1.1533	24.71	1.4896	28.66
75	14.6	1.1644	28.12	1.6798	30.15
76	15.5	1.1903	30.19	1.5378	34.5
77	10.0	1.0000	12.91	1.1116	12.93
78	8.9	0.9494	9.39	0.9982	9.96
79	11.2	1.0492	10.19	1.2218	16.48
80	10.2	1.0086	10.83	1.1308	13.02
81	13.0	1.1453	20.90	1.4046	25.32
82	18.4	1.2648	43.01	1.7067	46.66
83	16.4	1.2148	32.68	1.6927	39.18
84	13.8	1.1303	20.42	1.4548	28.38
85	12.0	1.0792	17.16	1.2890	19.45

TABLE 27 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
86	14.5	1.1614	26.39	1.4731	29.72
87	16.6	1.2201	34.39	1.6046	40.24
88	14.0	1.1661	28.42	1.4380	27.46
89	15.4	1.1875	30.84	1.2312	34.00
90	11.6	1.0645	17.81	1.2260	18.03
91	12.5	1.0969	20.78	1.3286	21.31
92	13.0	1.1139	22.39	1.3667	23.26
93	7.2	0.8273	4.32	0.7920	6.19
94	17.5	1.2430	44.91	1.6558	45.27
95	15.0	1.1761	30.28	1.5059	32.06
96	14.8	1.1703	27.74	1.4929	31.11
97	16.5	1.2172	34.84	1.5987	39.68
98	15.3	1.1847	31.25	1.5222	33.81
99	19.3	1.2856	52.16	1.7012	50.39
100	12.6	1.1004	19.87	1.2820	18.92
101	15.3	1.1847	33.48	1.5252	33.81
102	24.3	1.3856	84.84	1.9751	94.41
103	24.7	1.3927	96.00	1.9910	97.94
104	22.0	1.3424	77.29	1.8704	78.39
105	21.7	1.3365	90.01	1.8652	73.32
106	17.6	1.2455	44.49	1.6613	45.84
107	25.6	1.4082	82.42	2.0258	106.1
108	24.6	1.3909	82.71	1.9870	97.04
109	24.9	1.3962	110.77	1.9989	99.70
110	24.5	1.3892	100.97	1.9832	96.0
111	25.6	1.4082	87.81	2.0250	106.10
112	22.4	1.3502	88.13	1.8988	78.68
113	19.5	1.2900	27.74	1.7610	57.68
114	19.2	1.2842	61.21	1.7711	59.03
115	22.9	1.3598	81.61	1.9174	82.67

TABLE 27 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Predicted Leaf Area[a] (log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
116	22.6	1.3341	78.77	1.9046	80.27
117	25.5	1.4116	124.07	2.0334	108.00
118	21.4	1.3304	75.29	1.8515	71.04
119	20.5	1.3118	70.48	1.8098	64.53
120	21.4	1.3304	72.71	1.8515	71.04
121	15.6	1.1931	30.81	1.5440	35.00
122	15.5	1.1903	34.19	1.5377	34.49
123	16.5	1.2122	49.36	1.5869	38.62
124	15.9	1.2014	50.48	1.5626	36.52
125	15.1	1.1761	52.07	1.5009	32.06
126	14.8	1.1703	32.13	1.4929	31.11
127	15.9	1.2014	44.45	1.5626	36.52
128	15.7	1.1959	38.77	1.5502	36.52
129	18.3	1.2525	50.65	1.6994	50.05
130	21.0	1.3222	62.65	1.8331	68.10
131	23.7	1.3747	76.19	1.9507	89.26
132	22.6	1.3541	84.39	1.9046	80.28
133	19.3	1.2856	68.00	1.7512	56.59
134	19.0	1.2788	51.42	1.7385	54.49
135	16.5	1.2175	51.42	1.5986	39.68
136	21.3	1.3284	62.35	1.8470	70.30
137	14.4	1.1584	57.65	1.4663	29.26
138	24.1	1.3820	94.78	1.9671	92.75
139	19.1	1.2877	64.13	1.6807	48.53
140	16.4	1.2148	38.91	1.5926	39.14
141	19.5	1.2086	61.74	1.7912	65.39
142	14.7	1.1673	43.60	1.4862	30.64
143	15.4	1.1879	35.42	1.5314	34.00
144	20.5	1.3075	48.03	1.8000	59.17
145	21.7	1.3380	78.32	1.8652	75.52

TABLE 27 -- Continued

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm.^{2}) (Y)	log Predicted Leaf Area[a] (log Ŷ)	Predicted Leaf Area (Ŷ)
146	17.8	1.2504	43.03	1.6723	47.02
147	22.6	1.3541	77.42	1.9046	80.27
148	23.2	1.3655	70.08	1.9301	85.13
149	14.7	1.1673	34.32	1.4862	31.35
150	10.1	1.0043	13.23	1.1211	13.22

[a]Value obtained by solving the regression equation with the corresponding log X.

TABLE 28

SUMMARY SHEET OF CORRELATION COEFFICIENTS AND CURVILINEAR REGRESSION EQUATIONS EXPRESSING RELATIONSHIPS BETWEEN LENGTHS AND AREAS OF MANGO LEAVES

Type of Leaf	No. of Leaves	Correlation Coefficient	Curvilinear Regression Equation
Mature Haden	50	r^a = .9621**	(1) $\log \overset{*}{Y} = 1.9555 \log X - 0.7435$
Juvenile Haden	50	r = .9633**	(2) $\log \overset{*}{Y} = 2.2327 \log X - 1.1462$
Healthy Turpentine	50	r = .8992**	(3) $\log \overset{*}{Y} = 2.0063 \log X - 0.8126$
Composite Sample of Above Three Types	150	r = .9727**	(4) $\log \overset{*}{Y} = 2.2398 \log X - 1.1282$
Malformed Turpentine	56	r = .9409**	(5) $\log \overset{*}{Y} = 1.5509 \log X - 0.1727$

[a] $r_{.01}$ at 48 d.f. = .362; $r_{.01}$ at 148 d.f. = .208.

TABLE 29

DAILY WATER LOSS PER HOUR (GMS.)--SUM OF FOUR WATERING PERIODS

A. Water Loss Data

Replication No.	Days after Watering	April 14 (A) Veneer Graft (V)	April 14 (A) Chip Bud (C)	April 14 (A) Seedling Check (Ck)	May 5 (B) Veneer Graft (V)	May 5 (B) Chip Bud (C)	May 5 (B) Seedling Check (Ck)
1	1	9.62	8.28	17.56	17.56	12.19	17.14
	2	9.06	6.10	18.10	12.39	13.28	17.90
	3	7.85	5.85	16.74	12.68	13.91	17.65
Replication total		26.53	20.23	52.40	36.63	39.38	52.69
2	1	6.20	9.58	15.48	10.95	5.79	17.57
	2	7.37	10.54	16.20	11.58	6.55	18.06
	3	6.42	9.12	14.84	10.99	6.22	17.64
Replication total		19.99	29.24	46.52	33.52	18.56	53.27
3	1	7.10	6.26	17.15	12.40	2.69	13.10
	2	6.77	7.80	17.25	12.87	4.42	14.13
	3	6.82	7.62	14.66	12.85	3.94	14.43
Replication total		20.69	21.68	49.06	38.12	11.05	41.66
4	1	7.74	5.41	17.08	12.49	9.37	21.80
	2	9.73	5.29	19.01	15.20	10.76	31.25
	3	9.55	6.40	16.49	13.71	10.51	25.97
Replication total		27.02	17.10	52.58	41.40	30.64	79.02

TABLE 29 -- Continued

A. Water Loss Data (Cont.)

Replication No.	Days after Watering	April 14 (A) Veneer Graft (V)	April 14 (A) Chip Bud (C)	April 14 (A) Seedling Check (Ck)	May 5 (B) Veneer Graft (V)	May 5 (B) Chip Bud (C)	May 5 (B) Seedling Check (Ck)
5	1	13.25	.....	9.79	8.95	.....	10.21
	2	14.56	.....	11.19	14.15	.....	10.44
	3	14.23	.....	11.13	12.68	.....	8.94
Replication total		42.04	.....	32.11	35.78	.....	29.59
6	1	.....	.....	15.21	.....	.....	14.36
	2	.....	.....	17.92	.....	.....	16.26
	3	.....	.....	15.45	.....	.....	14.84
Replication total		.....	.....	45.58	.....	.....	45.46
Totals		136.27	88.25	281.25	185.45	99.63	301.69
Date of Graftage totals				505.77			586.77

TABLE 29 -- Continued

B. Water Loss Data

Replication No.	Days after Watering	Date of Graftage: July 4 (C) Veneer Graft (V)	July 4 (C) Chip Bud (C)	July 4 (C) Seedling Check (Ck)	July 21 (D) Veneer Graft (V)	July 21 (D) Chip Bud (C)	July 21 (D) Seedling Check (Ck)
1	1	2.49	3.97	10.62	4.54	3.55	13.05
	2	2.96	4.20	10.33	4.01	4.84	13.85
	3	2.30	5.47	11.02	4.39	4.95	13.40
Replication total		7.75	13.64	31.97	12.94	13.36	40.30
2	1	3.30	2.89	9.92	5.45	3.55	7.23
	2	4.42	4.00	10.33	7.16	5.04	8.41
	3	4.78	4.55	11.34	6.68	5.19	8.08
Replication total		12.50	11.44	31.59	19.29	13.78	23.72
3	1	5.22	.63	6.81	2.69	3.13	9.16
	2	5.91	.83	8.44	4.85	1.06	11.36
	3	6.79	1.25	7.88	3.76	1.03	10.60
Replication total		17.92	2.71	23.13	11.30	5.22	31.12
4	1	3.13	4.38	18.62	4.82	4.80	6.05
	2	3.79	5.06	20.34	5.71	6.31	6.77
	3	4.75	6.22	19.56	5.77	7.01	6.82
Replication total		11.67	15.66	58.52	16.30	18.12	19.64

TABLE 29 -- Continued

B. Water Loss Data (Cont.)

		Date of Graftage					
		July 4 (C)			July 21 (D)		
Replication No.	Days after Watering	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)
5	1	3.95	.....	6.46	4.38	.....	3.55
	2	4.43	.....	8.23	5.07	.....	4.22
	3	5.59	.....	8.03	5.77	.....	4.33
Replication total		13.97	.....	22.72	15.22	.....	12.10
6	1	.....	.....	12.28	.....	.....	11.65
	2	.....	.....	14.13	.....	.....	13.50
	3	.....	.....	12.58	.....	.....	12.57
Replication total		.....	.....	38.99	.....	.....	37.52
Totals		68.31	43.45	206.92	75.05	50.48	164.40
Date of graftage totals				314.18			289.93
Grand total							1696.65

TABLE 29 -- Continued

C Date of Graftage vs. Type of Graftage (D x G)

	Date of Graftage				
	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(G) Totals
Type of Graftage					
(V)	136.27(15)[a]	185.45	63.81	75.05	460.58(60)
(C)	88.25(12)	99.63	43.45	50.48	281.81(48)
(Ck)	281.25(18)	301.69	206.92	164.40	954.26(72)
(D) Totals	505.77(45)	586.77	314.18	289.93	1696.65(180)

D Date of Graftage vs. Days after Watering (T x D)

	Date of Graftage				
	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(T) Totals
Days after Watering					
1	165.71(15)	180.57	94.67	87.60	528.55(60)
2	176.89	209.24	187.40	102.16	595.69
3	163.17	196.96	112.11	100.17	572.41
(D) Totals	505.77(45)	586.77	314.18	289.93	1696.65(180)

E. Type of Graftage vs. Days after Watering (T x G)

	Types of Graftage			
	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)	(T) Totals
Days after Watering				
1	140.23(20)	86.47(16)	301.85(24)	528.55(60)
2	161.99	96.08	337.62	595.69
3	158.36	99.26	314.79	572.41
(G) Totals	460.58(60)	281.81(48)	954.26(72)	1696.65(180)

[a]Figures in parentheses denote number of items included in total.

TABLE 30

COMPARISON OF MEAN DAILY WATER LOSS PER HOUR, MEAN DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (TWO ANALYSES) FOR MAIN TREATMENTS (SINGLE WATERING PERIOD BASIS)

Treatment	Daily Water Loss/Hr. (gms.)	Daily Water Loss/Hr. / Cm.^{2} Stem Area (gms.)	Daily Water Loss/Hr. / 10 Dm.^{2} Leaf Area (gms.)	Daily Water Loss/Hr. / 10 Dm.^{2} Leaf Area[a] (gms.)
Type of Graftage (G)				
Veneer graft (V)	1.92(240)[b]	1.19(240)	4.05(240)	4.05(240)
Chip bud (C)	1.47(192)	.97(192)	6.47(192)	3.19(144)
Seedling check (Ck)	3.31(288)	3.01(288)	2.37(288)	2.37(288)
Date of Graftage (D)				
April 14 (A)	2.81(180)	2.58(180)	3.15(180)	3.06(168)
May 5 (B)	3.26	2.36	3.49	3.16
July 4 (C)	1.75	1.37	5.30	2.85
July 21 (D)	1.61	1.12	4.16	3.51
Days after Watering (T)				
1	2.20(240)	1.76(240)	3.84(240)	2.95(224)
2	2.48	1.94	4.29	3.31
3	2.39	1.87	3.94	3.18
Grand Mean	2.36(720)	1.86(720)	4.02(720)	3.15(672)

[a]Contains three instead of four chip bud replications.

[b]Figures in parentheses denote number of items per mean.

TABLE 31

MEAN DAILY WATER LOSS PER HOUR (GMS.) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASES

A. Date of Graftage *vs.* Type of Graftage (D x G)

	April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	2.27(60)[a]	3.89	1.86	1.28	1.92(240)
(C)	1.84(48)	2.88	.91	1.08	1.47(192)
(Ck)	3.91(72)	4.19	2.88	2.28	3.31(288)
(D) Means	2.81(180)	3.26	1.75	1.61	2.36(720)

B. Date of Graftage *vs.* Days after Watering (T x D)

	April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	2.76(60)	3.01	1.58	1.46	2.28(240)
2	2.95	3.49	1.79	1.78	2.48
3	2.72	3.28	1.87	1.67	2.39
(D) Means	2.81(188)	3.26	1.78	1.61	2.36(728)

C. Type of Graftage *vs.* Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	1.78(80)	1.38(64)	3.18(96)	2.28(240)
2	2.03	1.50	3.82	2.48
3	1.98	1.38	3.28	2.39
(G) Means	1.92(240)	1.47(192)	3.31(288)	2.36(728)

[a]Figures in parentheses denote number of items per mean.

TABLE 32

MEAN DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA (CMS.) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

	April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	1.54(60)[a]	1.76	.68	.73	1.19(240)
(G)	1.82(48)	1.27	.51	.85	.97(192)
(Ck)	4.16(72)	3.59	2.82	1.75	3.01(288)
(D) Means	2.58(180)	2.36	1.37	1.12	1.86(720)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	2.50(60)	2.28	1.25	1.03	1.76(240)
2	2.78	2.46	1.42	1.20	1.94
3	2.30	2.33	1.49	1.18	1.87
(D) Means	2.58(180)	2.36	1.37	1.12	1.86(720)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	1.13(80)	.86(64)	2.59(96)	1.76(240)
2	1.23	1.01	3.16	1.94
3	1.20	1.03	2.99	1.87
(G) Means	1.19(240)	.97(192)	3.01(288)	1.86(720)

[a]Figures in parentheses denote number of items per mean.

TABLE 33

MEAN DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS.) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

	April 14 (A)	May 6 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	3.06(60)[a]	3.03	3.42	5.09	4.03(240)
(C)	3.40(48)	4.04	11.93	5.63	6.47(192)
(Ck)	2.34(72)	2.31	2.44	2.40	2.37(288)
(D) Means	3.10(180)	3.49	5.30	4.16	4.02(720)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	3.04(60)	3.17	5.08	3.59	3.84(240)
2	3.31	3.72	6.61	4.50	4.29
3	3.10	3.58	4.70	4.39	3.94
(D) Means	3.10(180)	3.49	5.30	4.16	4.02(720)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	3.90(80)	6.09(64)	2.28(96)	3.84(240)
2	4.22	7.04	2.51	4.29
3	3.99	6.30	2.33	3.94
(D) Means	4.08(240)	6.47(192)	2.37(288)	4.02(720)

[a]Figures in parentheses denote number of items per mean.

TABLE 34

MEAN DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS^a) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS[a]

A. Date of Graftage vs. Type of Graftage (D x G)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	3.86(60)[b]	3.83	3.42	5.09	4.05(240)
(*C)[a]	3.18(36)	3.76	2.72	3.09	3.19(144)
(Ck)	2.34(72)	2.31	2.44	2.40	2.37(288)
(D) Means	3.06(168)	3.16	2.85	3.51	3.15(672)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	2.95(56)	2.86	2.65	3.33	2.95(224)
2	3.21	3.37	2.94	3.72	3.31
3	3.02	3.25	2.97	3.49	3.18
(D) Means	3.06(168)	3.16	2.85	3.51	3.15(672)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(*C)	(Ck)	(T) Means
Days after Watering				
1	3.93(80)	2.63(48)	2.28(96)	2.95(224)
2	4.22	3.39	2.51	3.31
3	3.99	3.55	2.33	3.18
(G) Means	4.05(240)	3.19(144)	2.37(288)	3.15(672)

[a]Contains three instead of four chip bud replications.

[b]Figures in parentheses denote number of items per mean.

TABLE 35

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE OF DAILY WATER LOSS PER HOUR, DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (TWO ANALYSES)

Source of Variation	Daily Water Loss/Hr.	Daily Water Loss/ Hr. /Cm.^{2} Stem Area	Daily Water Loss/ Hr./10 Dm.^{2} Leaf Area	Daily *Water Loss/ Hr./10 Dm.^{2} Leaf Area[a]
D[b]				
A, B vs. C, D	44.32[c]	47.65	n. s.	n. s.
A vs. B	n. s.	n. s.	n. s.	n. s.
C vs. D	n. s.	n. s.	n. s.	n. s.
(D)				
D_L	31.46	45.77	n. s.	n. s.
D_Q	n. s.	n. s.	n. s.	n. s.
Remainder	13.46	n. s.	n. s.	n. s.
G				
V, C vs. Ck	21.70	115.71	4.66*	36.65
V vs. C	40.00	n. s.	n. s.	8.08
T				
1, 2 vs. 3	n. s.	n. s.	n. s.	n. s.
1 vs. 2	52.18	33.25	n. s.	12.30
(T)				
1, 3 vs. 2	22.32	21.95	n. s.	7.44
1 vs. 3	31.63	11.91	n. s.	5.24*
(T)				
T_L	22.32	11.91	n. s.	5.24*
T_Q	31.63	21.95	n. s.	7.44
T x D				
T_L x D	3.97	n. s.	n. s.	n. s.
T_Q x D	3.05*	n. s.	n. s.	n. s.
(T x D)				
T x D_L	3.80*	n. s.	n. s.	n. s.
T x D_Q	3.40*	n. s.	n. s.	n. s.
Remainder	3.33*	n. s.	n. s.	n. s.

TABLE 35 -- Continued

Source of Variation	Daily Water Loss/Hr.	Daily Water Loss/ Hr./Cm.^{2} Stem Area	Daily Water Loss/ Hr./10 Dm.^{2} Leaf Area	Daily *Water Loss/ Hr./10 Dm.^{2} Leaf Area[a]
T x G				
T_L x G	n. s.	n. s.	n. s.	5.98
T_Q x G	4.82	3.72*	n. s.	n. s.

[a]Contains three instead of four chip bud replications.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

[c]Unless marked otherwise (single-starred or n. s.), the probability level is less than .01.

TABLE 36

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF DAILY WATER LOSS PER HOUR FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	179	4937.0480				
Main Plots	59	4797.8803				
Treatments	11	3362.4281	305.675	10.22**	1.99	2.64
D	3	1404.7889	468.263	15.66**	2.80	4.22
G	2	1845.1347	922.567	30.55**	3.19	5.08
D x G	6	112.4963	18.749	n.s.		
Error (a)	48	1430.4601	29.905			
Sub-Plots	120	139.1678				
T	2	38.7413	19.371	26.98**	3.09	4.82
T x D	6	15.1127	2.519	3.51**	2.19	2.99
T x G	4	7.7262	1.932	2.69*	2.46	3.51
T x D x G)	12) 108	77.5876	.718			
Error (b))	96)					

TABLE 36 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
B. Completed Analysis						
D	3	1404.7889				
A, B vs. C, D	1		1325.355	44.32**	4.04	7.19
A vs. B	1		72.900	2.44n.s.		
C vs. D	1		6.534	n.s.		
(D)[b]	3	1404.7889				
D_L	1		940.669	31.46**		
D_Q	1		61.542	n.s.		
Remainder	1		402.578	13.46**		
G	2	1845.1347				
V vs. C	1		1196.295	40.00**		
V, C vs. Ck	1		648.840	21.70**		
Error (a)	48		29.905			
T	2	38.7413				
1 vs. 2	1		37.565	52.18**	3.94	6.90
1, 2 vs. 3	1		1.176	n.s.		
(T)	2	38.7413				
1 vs. 3	1		22.710	31.63**		
1, 3 vs. 2	1		16.031	22.32**		
(T)	2	38.7413				
T_L	1		16.031	22.32**		
T_Q	1		22.710	31.63**		

TABLE 36 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis (Cont.)						
T x D	6	15.1127				
T_L x D	3	8.5439	2.848	3.97**	2.70	3.98
T_Q x D	3	6.5688	2.190	3.05*		
(T x D)	6	15.1127				
T x D_L	2	5.4528	2.726	3.80*	3.09	4.82
T x D_Q	2	4.8774	2.439	3.40*		
Remainder	2	4.7825	2.391	3.33*		
T x G	4	7.7262				
T_L x G	2	.7870	.393	n.s.		
T_Q x G	2	6.9390	3.470	4.82**	3.09	4.82
Error (b)	108		.718			

[a]Values corresponding to d.f. for item and respective error.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 37

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	Tabular F Values[a] .01
A. Preliminary Analysis						
Total	179	5068.8091				
Main Plots	59	4995.8287				
Treatments	11	3910.3336	355.476	15.72**	1.99	2.64
D	3	1117.1475	372.383	16.47**	2.80	4.22
G	2	2573.6539	1286.827	56.90**	3.19	5.08
D x G	6	219.5322	36.589	n. s.		
Error (a)	48	1085.4957	22.614			
Sub-Plots	120	72.9804				
T	2	15.4053	7.703	16.82**	3.09	4.82
T x D	6	2.5947	.432	n. s.		
T x G	4	4.0634	1.016	2.22n. s.	2.46	
T x D x G)	12) 108	49.5021	.458			
Error (b))	96)					

TABLE 37 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis						
D	3	1117.1475				
A, B vs. C, D	1		1077.561	47.65**	4.04	7.19
A vs. B	1		17.840	n.s.		
C vs. D	1		21.746	n.s.		
(D)[b]	3	1117.1475				
D_L	1		1034.973	45.77**		
D_Q	1		.097	n.s.		
Remainder	1		82.078	3.63n.s.		
G	2	2573.6539				
V vs. C	1		21.004	n.s.		
V, C vs. Ck	1		2552.650	115.71**		
Error (a)	48		22.614			
T	2	15.4053				
1 vs. 2	1		15.230	33.25**	3.94	6.90
1, 2 vs. 3	1		.176	n.s.		
(T)	2	15.4053				
1 vs. 3	1		5.355	11.91**		
1, 3 vs. 2	1		10.050	21.95**		
(T)	2	15.4053				
T_L	1		5.355	11.91**		
T_Q	1		10.050	21.95**		

TABLE 37 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
T x G	4	4.0634				
T_L x G	2	.6542	.327	n.s.		
T_Q x G	2	3.4092	1.704	3.72*	3.09	4.82
Error (b)	108		.458			

[a]Values corresponding to d.f. for item and respective error.

[b]Subscripts L and Q refer to linear and quardatic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 38

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values* .05	Tabular F Values* .01
A. Preliminary Analysis						
Total	179	75,291.8589				
Main Plots	59	70,875.8317				
Treatments	11	17,019.4188	1547.220	n.s.		
D	3	1,937.0613	645.687	n.s.		
G	2	7,740.3075	3870.154	3.44*	3.19	5.08
D x G	6	7,342.0500	1223.675	n.s.		
Error (a)	48	53,956.4129	1124.092			
Sub-Plots	120	4,316.0272				
T	2	103.4041	51.702	n.s.		
T x D	6	193.7473	28.555	n.s.		
T x G	4	51.9994	13.000	n.s.		
T x D x G)	12) 108	3,966.8764	36.730			
Error (b))	96)					

TABLE 38 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis						
G	2	7,740.3075				
V, C vs. Ck	1		5232.835	4.66*	4.04	7.19
V vs. C	1		2587.474	2.23		
Error (a)	48		1124.092			
T	2	103.4141				
1, 2 vs. 3	1		9.930	n.s.		
1 vs. 2	1		93.474	2.53n.s.	3.94	
(T)[b]	2	103.4041				
1, 3 vs. 2	1		98.974	2.68n.s.		
1 vs. 3	1		4.431	n.s.		
Error (b)	108		36.730			

[a]Values corresponding to d.f. for item and respective error.

[b]Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 39

ALTERNATE ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF DAILY *WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA[a] FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[b] .05	.01
A. Preliminary Analysis						
Total	167	3977.5908				
Main Plots	55	3370.3361				
Treatments	11	1925.4093	175.037	5.33**	2.01	2.68
D	3	153.2478	51.083	n.s.		
G	2	1468.8281	734.414	22.36	3.21	5.12
D x G	6	303.3334	50.556	n.s.		
Error (a)	44	1444.9268	32.839			
Sub-Plots	112	607.2547				
T	2	60.5786	30.289	6.34**	3.09	4.82
T x D	6	11.0036	1.834	n.s.		
T x G	4	58.0826	14.521	3.04*	2.46	3.51
T x D x G }	12} 100	477.5899	4.776			
Error (b) }	88}					

TABLE 39 -- Continued

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis						
G	2	1468.8281				
V vs. C	1		265.242	8.08**	4.06	7.24
V, C vs. Ck	1		1203.586	36.65**		
(G)[c]	2	1468.8281				
V vs. Ck	1		1467.471	44.69**		
V, Ck vs. C	1		1.357	n. s.		
Error (a)	44		32.839			
T	2	60.5786				
1 vs. 2	1		58.7541	12.30**	3.94	6.90
1, 2 vs. 3	1		1.8245	n. s.		
(T)	2	60.5786				
1 vs. 3 (T_L)	1		25.024	5.24*		
1, 3 vs. 2 (T_Q)	1		35.555	7.44**		
T x G	4	58.0826				
T_L x G	2	57.1173	28.559	5.98**	3.09	4.82
T_Q x G	2	.9653	.483	n. s.		
Error (b)	100		4.776			

[a]Three replications for chip bud treatments instead of four.

[b]Values corresponding to d. f. for item and respective error.

[c]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 40

DAILY WATER LOSS PER HOUR (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE (SUM OF FOUR WATERING PERIODS)

A. Water Loss Data

Replication No.	Days after Watering	Type of Graftage (V)	(C)	(S)	(Ck)
1	1	11.56	12.19	1.24	17.14
	2	12.39	13.28	3.16	17.90
	3	12.68	13.91	2.28	17.65
Replication total		36.63	39.35	6.68	32.69
2	1	10.95	8.79	2.29	17.87
	2	11.58	6.55	3.55	18.86
	3	15.99	6.22	3.83	17.68
Replication total		33.52	18.36	9.62	53.37
3	1	12.40	2.69	6.87	13.10
	2	12.87	4.42	6.97	14.13
	3	12.83	3.94	7.83	14.43
Replication total		38.13	11.08	21.66	41.66
4	1	12.49	9.37	6.23	21.88
	2	13.28	10.76	8.28	31.23
	3	13.71	15.51	5.62	25.97
Replication total		41.40	30.64	17.13	79.52
5	1	8.96	.....	.....	18.21
	2	14.16	.....	.....	15.44
	3	12.68	.....	.....	5.96
Replication total		30.75	.....	.....	29.59
6	1	.....	.....	.....	14.26
	2	.....	.....	.....	16.26
	3	.....	.....	.....	16.26
Replication total		.....	.....	.....	45.66
Totals		185.40	99.63	38.09	301.69
Grand total					64þ.06

TABLE 40 -- Continued

B. Type of Graftage vs. Days after Watering (T x G)

Days after Watering	Type of Graftage (V)	(C)	(S)	(Ck)	(T) Totals
1	56.35(6)[a]	30.04(4)	14.63(4)	94.10	197.20(19)
2	66.19	36.01	19.21	100.04	226.45
3	62.19	34.58	19.25	99.47	216.21
(G) Totals	185.45(16)	99.63(12)	55.09(12)	301.69(18)	641.86(57)

[a]Figures in parentheses denote number of items included in totals.

TABLE 41

COMPARISON OF MEAN DAILY WATER LOSS PER HOUR, MEAN DAILY WATER LOSS PER HOUR PER CM. ^{2} STEM AREA, AND MEAN DAILY WATER LOSS PER HOUR PER 10 DM. ^{2} LEAF AREA FOR PLANTS OF THE MAY 5 GRAFTAGE DATE MAIN TREATMENTS (SINGLE WATERING PERIOD BASIS)

		Daily Water Loss/Hr (gms.)	Daily Water Loss/Hr /Cm ^{2} Stem Area (gms.)	Daily Water Loss/Hr /10 Dm. ^{2} Leaf Area (gms.)
Type of Graftage	(G)			
Veneer graft	(V)	3.09(60)[a]	1.76(60)	3.83(60)
Chip bud	(C)	2.08(48)	1.27(48)	4.34(48)
Shield bud	(S)	1.15(48)	.78(48)	2.94(48)
Seedling check	(Ck)	4.19(72)	3.59(72)	2.31(72)
Days after Watering	(T)			
	1	2.60(76)	1.95(76)	3.08(76)
	2	3.01	2.11	3.60
	3	2.85	2.02	3.43
Grand Mean		2.82(228)	2.03(228)	3.37(228)

[a]Figures in parentheses denote number of items per mean.

TABLE 42

MEAN DAILY WATER LOSS PER HOUR (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE FOR ONE TREATMENT COMPARISON (FIRST ORDER INTERACTION) ON SINGLE WATERING PERIOD BASIS

Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(S)	(Ck)	(T) Means
Days after Watering					
1	2.52(20)[a]	1.88(16)	1.04(16)	3.93(24)	2.60(76)
2	3.31	2.19	1.20	4.50	3.81
3	3.15	2.16	1.20	4.15	2.85
(G) Means	3.09(60)	2.08(48)	1.15(48)	4.19(72)	2.82(228)

[a]Figures in parentheses denote number of items per mean.

TABLE 43

MEAN DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE FOR ONE TREATMENT COMPARISON (FIRST ORDER INTERACTION) ON SINGLE WATERING PERIOD BASES

Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(S)	(Ck)	(T) Means
Days after Watering					
1	1.77(20)[a]	1.15(16)	.71(16)	3.46(24)	1.98(76)
2	1.84	1.34	.81	3.73	2.11
3	1.66	1.31	.82	3.37	2.02
(G) Means	1.76(60)	1.27(48)	.78(48)	3.89(72)	2.03(228)

[a]Figures in parentheses denote number of items per mean.

TABLE 44

MEAN DAILY WATER LOSS PER HOUR PER 10 DM.[2] LEAF AREA (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE FOR ONE TREATMENT COMPARISON (FIRST ORDER INTERACTION) ON SINGLE WATERING PERIOD BASIS

Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(S)	(Ck)	(T) Means
Days after Watering					
1	3.51(20)[a]	4.14(16)	2.74(16)	2.24(24)	3.08(76)
2	4.10	5.30	3.17	2.36	3.60
3	3.88	5.09	2.98	2.32	3.43
(G) Means	3.83(60)	4.84(48)	2.96(48)	2.31(72)	3.37(228)

[a]Figures in parentheses denote number of items per mean.

TABLE 45

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE OF DAILY WATER LOSS PER HOUR, DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR PLANTS OF THE MAY 5 GRAFTAGE DATE

Source of Variation	Daily Water Loss/Hr	Daily Water Loss/ Hr. /Cm.^{2} Stem Area	Daily Water Loss/ Hr. /10 Dm.^{2} Leaf Area
G[a]	6.94[b]	13.32	4.70*
V, C, S vs. Ck	17.76	36.30	8.16
V, C, S	9.06	n.s.	5.95*
(G)			
V, C vs. S, Ck	n.s.	6.89	11.46
V vs. C	n.s.	n.s.	n.s.
S vs. Ck	23.00	32.17	n.s.
(G)			
V, Ck vs. S, C	21.46	23.36	n.s.
V vs. $\overline{Ck}$	n.s.	15.80	5.16*
S vs. C	n.s.	n.s.	5.95*
(G)			
V, S vs. C, Ck	6.33	14.40	n.s.
V vs. S	8.99	n.s.	n.s.
C vs. Ck	11.50	21.96	12.62
T	10.87	n.s.	4.57*
1, 2 vs. 3	n.s.	n.s.	n.s.
1 vs. 2	21.40	n.s.	17.06
(T)			
1, 3 vs. 2	13.81	n.s.	5.13*
1 vs. 3	7.92	n.s.	n.s.

[a]Items in parentheses denote additional breakdowns of treatments immediately preceding them.

[b]Unless marked otherwise (single-starred or n.s.), the probability level is less than .01.

TABLE 46

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 5 GRAFTAGE DATE OF DAILY WATER LOSS PER HOUR FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	56	1940.9744				
Main Plots	18	1873.6741				
G	3	1201.5694	400.523	8.94**		5.42
Error (a)	15	672.1047	44.807			
Sub-Plots	38	67.3003				
T	2	26.1011	13.051	10.87**		5.39
T x G	6	5.1613	.860	n.s.		
Error (b)	30	36.0379	1.201			
B. Completed Analysis						
G	3	1201.5694				
V, C, S vs. Ck	1		795.7704	17.76**	4.54	6.68
V, C, S	2		405.7999	9.06**	3.68	6.66
(G)[b]	3	1201.5694				
V, C vs. S, Ck	1		15.2941	n.s.		
V vs. C	1		109.9358	2.45n.s.		
S vs. Ck	1		1066.3395	23.80**		

TABLE 46 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis (Cont.)						
(G)	3	1201.5694				
V, Ck vs. S, C	1		960.7064	21.44**		
V vs. Ck	1		158.2001	3.53n.s.		
S vs. C	1		82.6629	n.s.		
(G)	3	1201.5694				
V, S vs. C, Ck	1		283.7413	6.33**		
V vs. S	1		402.7492	8.99**		
C vs. Ck	1		515.0787	11.50**		
T	2	26.1011				
1, 2 vs. 3	1		4021	n.s.	4.17	7.56
1 vs. 2	1		25.6990	21.40**		
(T)	2	26.1011				
1, 3 vs. 2	1		16.9911	13.81**		
1 vs. 3	1		9.5100	7.92**		

[a]Values corresponding to d.f. for item and corresponding error

[b]Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 47

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 5 GRAFTAGE DATE OF DAILY WATER LOSS PER HOUR PER CM.^{2} STEM AREA FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	56	1593.3130				
Main Plots	18	1554.8905				
G	3	1130.5815	376.861	13.32**		5.42
Error (a)	15	424.3090	28.287			
Sub-Plots	38	38.4225				
T	2	4.0626	2.0313	n.s.	3.32	
T x G	6	2.3930	.3655	n.s.		
Error (b)	30	31.9669	1.066			
B. Completed Analysis						
G	3	1130.5815				
V, C, S vs. Ck	1		1028.1635	36.35**		6.68
V, C, S	2	102.4179	51.214	n.s.	3.68	6.36
$(G)^b$	3	1130.5815				
V, C vs. S, Ck	1		194.9746	6.89**		
V vs. C	1		25.5715	n.s.		
S vs. Ck	1		910.0354	32.17**		

TABLE 47 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
(G)	3	1130.5815				
V, Ck vs. S, C	1		660.7376	23.36**		
V vs. Ck	1		446.9508	15.80**		
S vs. C	1		22.8931	n.s.		
(G)	3	1130.5815				
V, S vs. C, Ck	1		407.2872	14.40**		
V vs. S	1		102.0163	3.61n.s.		
G vs. Ck	1		621.2780	21.96**		
T	2	4.0626				
1, 2 vs. 3	1		.0489	n.s.	4.17	7.56
1 vs. 2	1		4.0137	3.77n.s.		

[a]Values corresponding to d.f. for item and corresponding error.

[b]Items in parentheses denote additional breakdowns of treatments immediately preceding them

TABLE 48

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 5 GRAFTAGE DATE OF DAILY WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING)

Source of Variation	d.f	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	56	1916.2740				
Main Plots	18	1704.9965				
G	3	826.5724	275.524	4.70*	3.29	5.42
Error (a)	15	878.4241	58.562			
Sub-Plots	38	211.2775				
T	2	43.2740	21.637	4.57*	3.32	5.39
T x G	6	25.8705	4.312	n.s.		
Error (b)	30	142.1330	4.738			
B. Completed Analysis						
G	3	826.5724				
V, C, S vs. Ck	1		477.851	8.16**		6.68
V, C, S	2		348.718	5.95*	3.68	6.36
(G)[b]	3	826.5724				
V, C vs. S, Ck	1		671.4016	11.46**		
V vs. C	1		109.6292	n.s.		
S vs. Ck	1		45.5416	n.s.		

TABLE 48 -- Continued

Source of Variation	d.f	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
(G)	3	826.5724				
V, Ck vs. C, S	1		176.2275	3.01n.s.		
V vs. Ck	1		302.1871	5.16*		
C vs. S	1		348.1578	5.95*		
(G)	3	826.5724				
V, S vs. C, Ck	1		2.7646	n.s.		
V vs. S	1		84.6014	n.s.		
C vs. Ck	1		739.2064	12.62**		
T	2	43.2740				
1, 2 vs. 3	1		1.7144	n.s.		
1 vs. 2	1		41.5561	17.86**		
(T)	2	43.2740				
1, 3 vs. 2	1		24.2882	5.13*		
1 vs. 3	1		18.9858	4.01n.s.		

[a]Values corresponding to d.f. for item and corresponding error.

[b]Items in parentheses denote additional breakdowns of treatments immediately preceding them

TABLE 49

WATER LOSS PER HOUR (GMS.)--SUM OF FOUR WATERING PERIODS

A. Water Loss Data

			Date of Graftage					
			April 14 (A)			May 8 (B)		
Replication No.	Days after Watering	Time of Day	Veneer Graft [V]	Chip Bud [C]	Seedling Check [Ck]	Veneer Graft [V]	Chip Bud [C]	Seedling Check [Ck]
1	1	(a)	28. 96	19. 97	47. 47	36. 52	35. 56	48. 55
		(b)	21. 96	17. 12	41. 23	31. 10	25. 04	43. 52
		(c)	1. 56	. 31	4. 54	2. 51	2. 50	3. 12
	Day subtotal		52. 49	37. 40	[illegible]	70. 13	65. 60	95. 49
	2	(a)	24. 64	16. 36	46. 52	31. 16	26. 94	44. 40
		(b)	28. 09	21. 65	55. 10	37. 78	48. 98	59. 26
		(c)	1. 71	. 55	4. 73	3. 24	2. 67	3. 75
	Day subtotal		54. 44	38. 56	106. 35	72. 18	78. 59	107. 64
	3	(a)	21. 67	17. 15	46. 64	34. 24	35. 15	47. 41
		(b)	15. 53	15. 53	40. 39	29. 31	35. 14	41. 83
		(c)	2. 19	. 64	3. 16	2. 21	2. 21	3. 79
	Day subtotal		[illegible]	[illegible]	[illegible]	[illegible]	78. 53	92. 73
Replication total			[illegible]	159. 88	[illegible]	[illegible]	[illegible]	[illegible]
2	1	(a)	25. 42	29. 33	42. 82	35. 30	25. 17	50. 29
		(b)	15: 19	20. 77	37. 95	29. 33	12. 35	32. 41
		(c)	. 63	1. 55	3. 43	1. 56	. 63	5. 50
	Day subtotal		39. 24	51. 65	83. 92	[illegible]	33. 15	88. 28

TABLE 49 -- Continued

A. Water Loss Data (Cont.) Replication No.	Days after Watering	Time of Day	Date of Graftage: April 14 (A) Veneer Graft (V)	April 14 (A) Chip Bud (C)	April 14 (A) Seedling Check (Ck)	May 3 (B) Veneer Graft (V)	May 3 (B) Chip Bud (C)	May 3 (B) Seedling Check (Ck)
2 (Cont.)	2	(a)	28.97	24.70	44.86	31.73	15.21	43.24
		(b)	21.90	37.20	44.81	33.67	88.30	50.28
		(c)	1.83	2.11	3.47	2.94	1.40	8.62
	Day subtotal		44.70	[illegible]	[illegible]	[illegible]	[illegible]	99.09
	3	(a)	16.98	25.45	41.11	30.90	19.23	46.08
		(b)	14.72	19.58	38.86	28.86	14.72	37.44
		(c)	1.58	2.22	4.10	2.49	.63	8.54
	Day subtotal		33.24	47.25	78.77	61.45	34.38	88.76
Replication total			117.19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	1	(a)	18.46	17.41	42.84	33.88	11.46	38.69
		(b)	19.39	18.31	40.59	29.29	9.70	33.05
		(c)	.94	.92	3.70	2.17	.31	2.17
	Day subtotal		38.79	36.64	86.83	65.34	21.49	73.91
	2	(a)	24.73	27.06	45.74	82.90	14.19	38.86
		(b)	18.73	18.32	81.83	44.45	13.21	45.32
		(c)	.60	1.24	3.42	1.87	.88	1.58
	Day subtotal		41.06	46.62	100.99	[illegible]	28.26	83.73

TABLE 49 -- Continued

A. Water Loss Data (Cont.) Replication No.	Days after Watering	Time of Day	April 14 (A) Veneer Graft (V)	April 14 (A) Chip Bud (C)	April 14 (A) Seedling Check (Ck)	May 5 (B) Veneer Graft (V)	May 5 (B) Chip Bud (C)	May 5 (B) Seedling Check (Ck)
5 (Cont.)	3	(a)	19.00	21.35	57.97	38.92	12.27	36.50
		(b)	15.92	19.81	30.05	26.81	0.00	35.42
		(c)	.60	1.25	5.52	1.87	.00	1.50
	Day subtotal		[illegible]	43.31	72.95	[illegible]	[illegible]	74.90
Replication total			116.05	126.57	260.77	213.15	68.60	234.50
4	1	(a)	81.50	11.57	40.73	29.68	27.53	03.20
		(b)	21.26	17.05	44.27	36.97	25.54	71.68
		(c)	2.80	1.25	4.64	2.75	1.83	7.78
	Day subtotal		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	2	(a)	35.47	19.70	54.63	47.15	35.17	00.98
		(b)	20.75	15.75	47.92	37.44	20.07	63.72
		(c)	1.33	0.00	4.05	2.79	1.88	6.01
	Day subtotal		[illegible]	[illegible]	[illegible]	87.37	[illegible]	158.71
	5	(a)	25.91	19.46	42.58	39.01	50.47	66.03
		(b)	31.53	13.54	47.87	55.97	32.07	70.19
		(c)	2.02	2.15	4.85	3.68	3.10	7.00
	Day subtotal		60.06	34.95	94.90	79.53	63.64	151.22
Replication total			151.92	101.42	291.23	235.41	181.18	442.54

TABLE 49 -- Continued

A. Water Loss Data (Cont.)

Replication No.	Days after Watering	Time of Day	April 14 (A) Veneer Graft (V)	April 14 (A) Chip Bud (C)	April 14 (A) Seedling Check (Ck)	May 5 (B) Veneer Graft (V)	May 5 (B) Chip Bud (C)	May 5 (B) Seedling Check (Ck)
5	1	(a)	32.50	....	22.88	23.54	....	27.06
		(b)	38.89	....	31.07	26.78	....	25.80
		(c)	3.73	....	1.87	1.86	....	2.80
	Day subtotal		66.32	....	55.02	52.18	....	55.66
	2	(a)	44.86	....	38.71	46.55	....	32.88
		(b)	33.98	....	28.32	33.01	....	24.37
		(c)	2.78	....	1.24	1.85	....	1.89
	Day subtotal		81.62	....	68.27	81.41	....	59.14
	3	(a)	38.58	....	31.27	33.57	....	24.13
		(b)	37.32	....	27.91	34.75	....	20.92
		(c)	3.88	....	3.37	3.92	....	3.07
	Day subtotal		79.78	....	62.55	72.24	....	48.12
Replication total			227.72	....	185.84	205.83	....	162.92
6	1	(a)	....	....	38.29	....	....	31.31
		(b)	....	....	35.98	....	....	36.84
		(c)	....	....	4.34	....	....	4.65
	Day subtotal		....	....	78.61	....	....	72.80

TABLE 49 -- Continued

A. Water Loss Data (Cont.)			Date of Graftage					
			April 14 (A)			May 5 (B)		
Replication No.	Days after Water	Time of Day	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)
6	2	(a)	.....	.....	50.87	.....	.....	48.72
(Cont.)		(b)	.....	.....	38.03	.....	.....	38.15
		(c)	.....	.....	3.70	.....	.....	3.12
	Day subtotal		.....	.....	92.60	.....	.....	89.99
	3	(a)	.....	.....	43.35	.....	.....	42.04
		(b)	.....	.....	42.13	.....	.....	37.23
		(c)	.....	.....	3.34	.....	.....	4.28
	Day subtotal		.....	.....	88.82	.....	.....	83.55
Replication total			.....	.....	260.03	.....	.....	246.34
Totals			769.47	500.78	1539.28	1059.42	577.14	1658.13
Date of graftage total					2809.53			3294.69

TABLE 49 -- Continued

B. Water Loss Data

Replication No.	Days after Watering	Time of Day	July 4 (C) Veneer Graft V	July 4 (C) Chip Bud C	July 4 (C) Seedling Check Ck	July 21 (D) Veneer Graft V	July 21 (D) Chip Bud C	July 21 (D) Seedling Check Ck
1	1	(a)	9.87	13.49	29.61	15.88	13.18	41.66
		(b)	3.58	8.67	30.54	14.33	6.30	27.23
		(c)	.63	.94	1.88	.95	.62	4.04
	Day subtotal		14.08	23.10	62.03	31.16	20.10	72.93
	2	(a)	6.99	11.50	25.71	10.52	16.42	32.47
		(b)	7.77	14.22	35.02	12.30	12.79	41.39
		(c)	1.18	.32	2.04	.88	.88	4.18
	Day subtotal		15.94	26.04	62.77	23.70	30.09	78.04
	3	(a)	9.67	17.03	29.45	13.45	14.42	37.96
		(b)	2.50	13.47	25.69	10.97	8.47	29.17
		(c)	.63	.95	2.84	.64	1.54	3.16
	Day subtotal		12.80	31.45	57.98	25.06	24.43	70.29
Replication total			42.82	80.59	182.78	79.92	74.52	221.26
2	1	(a)	14.11	10.25	28.84	15.30	10.95	20.89
		(b)	9.76	5.11	25.58	11.26	9.79	17.20
		(c)	.31	.64	1.57	1.25	.62	1.58
	Day subtotal		24.18	16.00	55.99	27.81	21.36	39.76

TABLE 49 -- Continued

B. Water Loss Data (Cont.)

Replication No.	Days after Watering	Time of Day	Date of Graftage: July 4 (C) — Veneer Graft (V)	July 4 (C) — Chip Bud (C)	July 4 (C) — Seedling Check (Ck)	July 21 (D) — Veneer Graft (V)	July 21 (D) — Chip Bud (C)	July 21 (D) — Seedling Check (Ck)
2 (Cont.)	2	(a)	14.53	9.37	28.14	17.65	14.83	28.91
		(b)	12.29	13.39	33.38	24.69	17.56	25.92
		(c)	.95	.88	1.73	1.12	.37	2.38
		Day subtotal	27.26	23.64	63.22	43.46	32.16	49.13
	3	(a)	14.63	10.93	30.47	18.18	13.22	20.28
		(b)	9.72	9.72	23.56	18.47	12.22	13.47
		(c)	.93	1.35	2.84	.64	1.27	3.48
		Day subtotal	25.35	22.23	58.87	37.21	26.71	37.23
Replication total			[illegible]	[illegible]1.87	178.88	188.48	80.23	[illegible].12
3	1	(a)	8.93	4.50	21.29	12.73	2.23	28.46
		(b)	12.23	5.80	18.57	6.25	14.36	20.78
		(c)	1.36	8.08	1.24	.92	8.00	2.81
		Day subtotal	22.72	4.38	38.40	19.90	28.19	31.97
	2	(a)	18.89	1.11	18.77	18.25	10.41	27.58
		(b)	13.87	3.10	27.61	11.96	10.14	33.47
		(c)	.92	.30	2.38	1.51	.32	3.54
		Day subtotal	33.68	4.31	48.76	28.72	20.87	64.81

TABLE 49 --Continued

B. Water Loss Data (Cont.)			Date of Graftage					
			July 4 (C)			July 21 (D)		
Replication No.	Days after Watering	Time of Day	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)
3 (Cont.)	3	(a)	17.70	6.55	23.59	10.94	6.96	26.57
		(b)	17.39	5.55	14.72	8.57	6.23	19.44
		(c)	2.49	.32	2.21	.64	2.16	3.48
	Day subtotal		37.48	6.37	40.82	20.15	13.33	49.79
Replication total			93.98	15.38	127.18	68.77	56.39	168.77
4	1	(a)	9.69	15.62	39.22	15.88	15.52	17.73
		(b)	7.69	9.25	52.66	15.72	13.56	14.25
		(c)	.92	1.56	5.48	1.36	1.24	1.26
	Day subtotal		18.30	21.47	97.46	23.08	28.61	33.19
	2	(a)	10.75	15.52	61.54	17.68	26.13	23.62
		(b)	12.48	13.36	52.48	15.28	15.17	14.48
		(c)	.32	.32	4.33	.60	.96	1.21
	Day subtotal		23.55	32.50	118.35	33.33	37.26	39.31
	3	(a)	10.77	14.07	55.73	13.82	16.52	20.13
		(b)	15.98	19.13	53.69	15.88	24.77	17.22
		(c)	2.47	2.61	5.74	2.13	1.50	3.45
	Day subtotal		24.22	35.51	118.16	31.83	43.09	40.80
Replication total			[illegible].97	89.75	325.97	97.[illegible]	105.9[illegible]	113.30

TABLE 49 -- Continued

B. Water Loss Data (Cont.)

Replication No.	Days after Water	Time of Day	July 9 (C) Veneer Graft (V)	July 9 (C) Chip Bud (C)	July 9 (C) Seedling Check (Ck)	July 21 (D) Veneer Graft (V)	July 21 (D) Chip Bud (C)	July 21 (D) Seedling Check (Ck)
5	1	(a)	7.74	.....	15.68	11.99	.....	8.68
		(b)	12.95	.....	18.55	14.11	.....	11.97
		(c)	1.24	.....	1.23	.61	.....	.31
	Day subtotal		21.93	.....	35.46	26.71	.....	20.96
	2	(a)	14.24	.....	31.00	20.11	.....	14.14
		(b)	8.78	.....	10.95	12.11	.....	12.11
		(c)	.96	.....	1.24	0.00	.....	0.00
	Day subtotal		23.98	.....	48.27	32.22	.....	26.28
	3	(a)	13.07	.....	20.38	10.69	.....	12.16
		(b)	14.98	.....	21.27	12.31	.....	12.00
		(c)	2.17	.....	2.99	2.43	.....	1.21
	Day subtotal		30.22	.....	44.86	30.43	.....	25.37
Replication total			76.13	.....	128.29	89.36	.....	72.58
6	1	(a)	.....	.....	34.00	.....	.....	29.18
		(b)	.....	.....	25.33	.....	.....	27.66
		(c)	.....	.....	2.80	.....	.....	2.80
	Day subtotal		.....	.....	62.10	.....	.....	58.64

TABLE 49 -- Continued

B Water Loss Data (Cont.)

Replication No.	Days after Watering	Time of Day	July 4 (C) Veneer Graft (V)	July 4 (C) Chip Bud (C)	July 4 (C) Seedling Check (Ck)	July 21 (D) Veneer Graft (V)	July 21 (D) Chip Bud (C)	July 21 (D) Seedling Check (Ck)
6 (Cont.)	2	(a)	.....	.....	42.67	.....	.....	40.80
		(b)	.....	.....	36.66	.....	.....	34.17
		(c)	.....	.....	3.43	.....	.....	2.18
	Day subtotal		.....	.....	82.76	.....	.....	77.15
	3	(a)	.....	.....	32.53	.....	.....	32.60
		(b)	.....	.....	32.23	.....	.....	35.93
		(c)	.....	.....	3.93	.....	.....	3.07
	Day subtotal		.....	.....	68.69	.....	.....	71.60
Replication total			.....	.....	213.63	.....	.....	208.39
Totals			355.75	247.62	1155.93	434.17	317.20	907.42
Date of graftage total					1759.30			1658.79
Grand total								9522.31

TABLE 69 -- Continued

C. Date of Graftage vs. Type of Graftage (D x G)

Type of Graftage	Date of Graftage April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(G) Totals
(V)	769.47(45)[a]	1089.42	358.75	434.17	2618.81(180)
(C)	500.78(36)	577.14	247.62	317.28	1642.74(144)
(Ck)	1539.28(54)	1658.13	1155.93	987.42	5260.76(216)
(D) Totals	2809.83(135)	3294.69	1759.30	1658.79	9522.31(540)

D. Date of Graftage vs. Days after Watering (T x D)

Days after Watering	Date of Graftage April 14 (A)	May 5 (B)	July 6 (C)	July 21 (D)	(T) Totals
1	884.50(49)	1017.26	517.88	494.37	2913.68(188)
2	1033.95	1197.98	635.24	615.90	3483.88
5	891.25	1097.50	606.26	540.82	3125.88
(D) Totals	2889.83(135)	3294.69	1759.30	1658.79	9522.31(540)

E. Type of Graftage vs. Days after Watering (T x G)

Days after Watering	Type of Graftage Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ck)	(T) Totals
1	795.85(60)	483.15(48)	1635.48(78)	2913.68(188)
3	955.13	602.44	1925.48	3483.88
5	868.63	587.18	1699.50	3125.50
(G) Totals	2618.81(180)	1642.74(144)	5260.76(216)	9522.31(540)

TABLE 49 -- Continued

F. Date of Graftage vs Time of Day (P x D)

	Date of Graftage				
	April 14 (A)	May 5 (B)	July 4 (C)	July 31 (D)	(P) Totals
Time of Day					
(a)	1480.27(45)	1617.11	872.00	833.88	4723.26(180)
(b)	1298.43	1545.20	809.18	753.29	4406.10
(c)	110.83	132.30	78.12	71.62	392.95
(D) Totals	2908.53(135)	3294.69	1759.30	1658.79	9522.31(540)

G. Type of Graftage vs. Time of Day (P x G)

	Type of Graftage			
	Veneer Graft (V)	Chip Bud (C)	Seedling Check (Ch)	(P) Totals
Time of Day				
(a)	1380.34(60)	820.44(48)	2584.48(72)	4723.86(180)
(b)	1198.67	765.46	2441.97	4406.10
(c)	101.80	56.84	234.31	392.95
(G) Totals	2618.81(160)	1642.74(144)	5260.76(216)	9522.31(540)

H. Days after Watering vs. Time of Day (P x T)

	Days after Watering			
	1	2	3	(P) Totals
Time of Day				
(a)	1447.74(60)	1719.32	1556.20	4723.26(180)
(b)	1345.65	1647.42	1413.03	4406.10
(c)	120.29	116.31	156.35	392.95
(T) Totals	2913.68(180)	3483.05	3125.58	9522.31(540)

[a]Figures in parentheses denote number of items included in total.

TABLE 50

COMPARISON OF MEAN WATER LOSS PER HOUR, MEAN WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (TWO ANALYSES) FOR MAIN TREATMENTS (BASIS OF ONE WATERING PERIOD)

Treatment	No. Items/ Mean	Water Loss/ Hr (gms.)	Water Loss/ Hr /Cm.^{2} Stem Area [illegible]	Water Loss/ Hr / 10 Dm.^{2} Leaf Area [illegible]	Water Loss/ Hr / 10 Dm.^{2} Leaf Area[a] [illegible]
Type of Graftage (G)					
Veneer graft (V)	720	3.60	2.26	7.69	7.69(720)
Chip bud (C)	576	2.85	1.90	16.00	6.32(432)
Seedling check (Ck)	864	6.09	5.54	4.44	4.44(864)
Date of Graftage (D)					
April 14 (A)	540	5.20	4.78	6.04	8.88(504)
May 5 (B)	540	4.10	4.42	6.65	6.04(504)
July 4 (C)	540	3.26	2.56	10.39	5.47(504)
July 21 (D)	540	3.07	2.15	11.36	6.63(504)
Days after Watering (T)					
1	720	4.05	3.21	9.24	8.56(672)
2	720	4.84	3.83	9.86	6.58(672)
3	720	4.34	3.38	7.23	5.87(672)
Time of Day (P)					
Morning (a)	720	6.56	5.16	12.81	9.04(672)
Afternoon (b)	720	6.12	4.82	12.15	8.28(672)
Evening (c)	720	.65	.45	.87	.70(672)
Grand Mean	2160	4.41	3.47	8.61	6.00(2016)

[a]Contains three instead of four chip bud replications, corrected numbers of items per mean being in parentheses.

TABLE 81

MEAN WATER LOSS PER HOUR (GMS.) FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

	April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	4.28(180)[a]	0.09	1.98	2.41	2.64(720)
(C)	3.48(144)	4.01	1.72	3.28	2.83(376)
(Ck)	7.13(216)	7.68	5.38	4.28	6.09(864)
(D) Means	5.20(540)	6.10	3.26	3.07	4.41(2160)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	4.91(180)	5.68	2.88	2.78	4.08(728)
2	0.78	6.66	3.84	3.42	4.84
3	4.93	6.08	3.37	3.85	4.34
(D) Means	5.20(540)	6.10	3.36	3.07	4.41(2160)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	3.31(240)	3.52(192)	5.68(288)	4.05(720)
3	3.98	3.14	6.69	4.84
3	3.62	3.90	8.90	4.34
(G) Means	3.64(720)	3.88(876)	6.09(864)	4.41(2160)

TABLE 51 -- Continued

D. Date of Graftage vs. Time of Day (P x D)

Time of Day	April 14 (A)	May 5 (B)	July 4 (C)	July 31 (D)	(P) Means
(a)	7.78(158)	8.98	4.88	4.63	6.86(728)
(b)	7.21	8.89	4.45	4.19	6.12
(c)	.63	.74	.44	.40	.55
(D) Means	5.20(540)	6.10	3.26	3.87	4.41(2160)

E. Type of Graftage vs. Time of Day (P x G)

Time of Day	(V)	(C)	(Ck)	(P) Means
(a)	5.49(240)	4.87(192)	8.98(288)	6.56(720)
(b)	8.88	8.99	8.48	6.12
(c)	.43	.38	.81	.88
(G) Means	3.64(728)	2.85(576)	6.89(864)	4.41(2160)

F. Days after Watering vs. Time of Day (P x T)

Time of Day	1	2	3	(P) Means
(a)	6.83(240)	7.17	6.49	6.56(720)
(b)	8.61	6.87	8.88	6.12
(c)	.50	.49	.65	.88
(T) Means	4.05(720)	4.84	4.34	4.41(2160)

[a]Figures in parentheses denote number of items per mean.

TABLE 22

MEAN WATER LOSS PER HOUR PER CM.^{2} STEM AREA (GMS.) FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (B x G)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	2.91(128)[a]	3.82	1.27	1.54	2.26(722)
(C)	2.92(144)	2.20	.96	1.28	1.90(376)
(Ck)	7.87(216)	6.60	4.69	2.29	3.54(864)
(D) Means	4.78(540)	4.47	2.26	2.12	3.47(2160)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 2 (B)	July 4 (C)	July 21 (D)	(T) Means
Days after Watering					
1	4.50(180)	4.17	2.22	1.92	2.21(720)
2	2.29	4.88	2.72	2.42	2.83
3	4.54	4.23	2.64	2.98	3.38
(D) Means	4.78(540)	4.42	2.26	2.12	2.47(2160)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	2.18(240)	1.70(192)	2.18(288)	3.21(720)
2	2.45	2.12	6.12	3 23
8	2.23	1.87	8.33	3.38
(G) Means	2.26(720)	1.90(376)	3.54(864)	2.47(2160)

TABLE 52 -- Continued

D. Date of Graftage vs. Time of Day (P x D)

Time of Day		April 14 (A)	May 5 (B)	July 4 (C)	July 31 (D)	(P) Means
	(a)	7.15(185)	6.55	4.32	3.19	5.16(720)
	(b)	6.64	6.13	4.81	2.99	4.82
	(c)	.59	.58	.44	.28	.45
(D) Means		4.78(540)	4.48	2.56	3.15	3.47(2160)

E. Type of Graftage vs. Time of Day (P x G)

Time of Day		(V)	(C)	(Ck)	(P) Means
	(a)	3.41(240)	2.51(192)	8.18(288)	5.14(720)
	(b)	5.09	2.66	7.78	4.82
	(c)	.39	.22	.74	.48
(G) Means		3.26(720)	1.90(576)	5.54(864)	3.47(2160)

F. Days after Watering vs. Time of Day (P x T)

Time of Day		1	2	3	(P) Means
	(a)	4.76(240)	5.62	5.09	5.16(720)
	(b)	4.45	5.45	4.88	4.82
	(c)	.42	.41	.51	.45
(T) Means		3.21(720)	3.83	3.38	3.47(2160)

[a]Figures in parentheses denote number of items per mean.

TABLE 53

MEAN WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS.) FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

	April 16 (A)	May 3 (B)	July 6 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	7.73(138)[a]	7.24	6.50	9.56	7.69(723)
(C)	6.88(144)	9.40	33.33	23.93	16.00(376)
(Ck)	4.30(216)	4.31	4.40	6.48	4.44(864)
(D) Means	6.04(540)	6.63	18.39	11.36	8.61(2160)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 3 (B)	July 6 (C)	July 21 (D)	(T) Means
Days after Watering					
1	3.66(180)	6.13	18.59	12.58	9.24(720)
2	6.67	7.31	11.33	13.92	9.36
3	8.78	6.49	9.87	7.37	7.23
(D) Means	6.04(540)	6.68	18.39	11.36	8.61(2160)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(Ck)	(T) Means
Days after Watering				
1	7.47(240)	17.30(192)	4.89(288)	9.24(720)
2	8.26	19.30	4.89	9.86
3	7.38	11.40	6.33	7.23
(G) Means	7.69(720)	16.00(376)	4.44(864)	8.61(2160)

TABLE 93 -- Continued

D. Date of Graftage vs. Time of Day (P x D)

Time of Day		April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(P) Means
	(a)	9.12(180)	9.96	17.78	14.37	12.81(720)
	(b)	8.34	9.23	12.40	18.64	12.18
	(c)	.64	.74	1.86	1.86	.87
(D) Means		6.84(540)	6.68	10.39	11.36	8.61(2160)

E. Type of Graftage vs. Time of Day (P x G)

Time of Day		(V)	(C)	(Ck)	(P) Means
	(a)	11.58(240)	23.66(192)	6.58(288)	12.81(720)
	(b)	10.63	23.82	6.18	12.18
	(c)	.87	.86	.87	.87
(G) Means		7.69(720)	16.00(876)	4.44(864)	8.61(2160)

F. Days after Watering vs. Time of Day (P x T)

Time of Day		1	2	3	(P) Means
	(a)	12.95(240)	12.82	12.63	12.81(720)
	(b)	12.60	15.98	7.88	12.18
	(c)	.67	.76	1.18	.87
(T) Means		9.24(720)	9.86	7.23	8.61(2160)

[a]Figures in parentheses denote number of items per mean.

TABLE 54

MEAN[a] WATER LOSS PER HOUR PER 18 DM.^{2} LEAF AREA (GMS.)[a] FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

	April 14 (A)	May 5 (B)	July 4 (C)	July 21 (D)	(G) Means
Type of Graftage					
(V)	7.48(180)[b]	7.26	6.88	9.86	7.69(728)
(°C)[a]	6.38(108)	7.49	8.54	6.04	6.32(432)
(Ck)	4.30(216)	4.31	8.18	4.48	6.44(864)
(D) Means	5.88(504)	6.04	8.47	6.63	6.80(2816)

B. Date of Graftage vs. Days after Watering (T x D)

	April 14 (A)	May 5 (B)	July 6 (C)	July 21 (D)	(T) Means
Days after Watering					
1	5.49(168)	5.54	5.29	5.93	5.56(672)
2	6.48	6.78	5.66	7.49	6.58
3	8.68	5.88	5.46	6.47	5.87
(D) Means	8.88(854)	6.84	5.47	6.63	6.80(2816)

C. Type of Graftage vs. Days after Watering (T x G)

	(V)	(°C)	(Ck)	(T) Means
Days after Watering				
1	7.67(240)	8.33(144)	6.89(288)	5.86(672)
2	8.26	7.14	4.89	6.58
3	7.38	6.47	6.35	5.87
(G) Means	7.69(720)	6.32(432)	6.44(864)	6.88(2016)

TABLE 54 -- Continued

D. Date of Graftage vs. Time of Day (P x D)

		April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D)	(P) Means
Time of Day						
	(a)	8.90(168)	8.97	8.26	10.02	9.04(672)
	(b)	8.10	8.43	7.46	9.12	8.28
	(c)	.63	.71	.78	.78	.78
(D) Means		5.88(504)	6.04	5.47	6.63	6.80(2016)

E. Type of Graftage vs. Time of Day (P x G)

		(V)	(*G)	(Ck)	(P) Means
Time of Day					
	(a)	11.88(240)	9.74(144)	6.40(288)	9.04(672)
	(b)	10.63	8.86	6.18	8.28
	(c)	.87	.68	.87	.78
(G) Means		7.69(720)	6.32(432)	4.44(864)	6.80(2016)

F. Days after Watering vs. Time of Day (P x T)

		1	2	3	(P) Means
Time of Day					
	(a)	8.36(224)	9.83	8.92	9.04(672)
	(b)	7.78	9.29	7.54	8.28
	(c)	.62	.61	.86	.70
(T) Means		6.86(672)	6.88	6.87	6.80(2016)

[a]Contains three instead of four chip bud replications.

[b]Figures in parentheses denote number of items per mean.

TABLE 55

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE OF WATER LOSS PER HOUR, WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND WATER LOSS PER HOUR PER 12 DM.^{2} LEAF AREA (TWO ANALYSES)

Source of Variation	Water Loss/Hr.	Water Loss/ Hr. /Cm.^{2} Stem Area	Water Loss/ Hr. /12 Dm.^{2} Leaf Area	Water Loss/ Hr. /12 Dm.^{2} Leaf Area[a]
D[b]				
A, B vs. C, D	45.52[c]	45.55	n. s.	n. s.
A vs. B	n. s.	n. s.	n. s.	n. s.
C vs. D	n. s.	n. s.	n. s.	n. s.
(D)				
D_L	21.38	46.04	n. s.	n. s.
D_Q	n. s.	n. s.	n. s.	n. s.
Remainder	15.06	42.33	n. s.	n. s.
G				
V, C vs. Ck	55.45	112.29	4.10*	22.06
V vs. C	n. s.	n. s.	n. s.	15.00
T				
1, 2 vs. 3	n. s.	6.22*	4.13*	n. s.
1 vs. 2	130.72	96.45	n. s.	25.29
(T)				
1, 2 vs. 3	115.46	121.71	n. s.	27.09
1 vs. 2	12.12	5.29	n. s.	n. s.
(T)				
T_L	18.11	2.09	n. s.	n. s.
T_Q	115.46	121.71	n. s.	27.09
T x D				
T_L x D	n. s.	n. s.	n. s.	n. s.
T_Q x D	2.11*	4.15	n. s.	n. s.
(T x D)				
T x D_L	4.22*	2.92	n. s.	n. s.
T x D_Q	n. s.	n. s.	n. s.	n. s.
Remainder	n. s.	n. s.	n. s.	n. s.
T x G				
T_L x G	n. s.	n. s.	n. s.	n. s.
T_Q x G	6.23	14.23	n. s.	n. s.

TABLE 95 -- Continued

Source of Variation	Water Loss/Hr.	Water Loss/ Hr. /Cm.2 Stem Area	Water Loss/ Hr./10 Dm.^{2} Leaf Area	*Water Loss/ Hr./10 Dm.^{2} Leaf Area[a]
P				
a, b vs. c	3159.48	1722.14	35.89	1503.23
a vs. b	9.36	7.26	n.s.	10.84
(P)				
P_L	1745.57	1397.5	28.48	1237.84
P_Q	423.76	340.84	7.52	275.62
P x D				
P_L x D	48.45	49.99	n.s.	n.s.
P_Q x D	15.29	13.89	n.s.	n.s.
(P x D)				
P x D_L	62.09	56.69	n.s.	n.s.
P x D_Q	4.51*	n.s.	n.s.	n.s.
Remainder	29.52	7.62	n.s.	n.s.
P x G				
P_L x G	75.32	158.26	4.36*	39.71
P_Q x G	32.70	42.62	n.s.	7.50
P x T				
P_L x T	6.72	4.16*	n.s.	n.s.
P_Q x T	3.61*	3.74*	n.s.	3.50*
(P x T)				
P x T_L	n.s.	n.s.	n.s.	n.s.
P x T_Q	6.94	7.54	n.s.	3.92*

[a]Contains three instead of four chip bud replications.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

[c]Unless marked otherwise (single-starred or n.s.), the probability level is less than .01.

TABLE 56

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	Tabular F Values[a] .01
A. Preliminary Analysis						
Total	539	135,935.6521				
Main Plots	59	46,777.3512				
Treatments	11	32,686.0789	2,971.462	10.16**	1.99	2.64
D	3	14,270.8506	4,756.950	16.20**	2.80	4.22
G	2	17,053.3876	8,526.694	29.05**	3.19	5.08
D x G	6	1,361.8407	226.973	n.s.	2.21	3.04
Error (a)	48	14,091.2723	293.568			
Sub-Plots	120	1,856.1541				
T	2	920.1270	460.064	66.78**	3.09	4.82
T x D	6	102.7798	17.130	2.49*	2.19	2.99
T x G	4	89.2744	22.319	3.24*	2.46	3.51
T x D x G)	12) 108					
Error (b))	96)	743.9729	6.889			
Sub-Sub-Plots	360	87,302.1468				
P	2	64,736.2002	32,368.100	108.44**	3.03	4.68
P x D	6	5,707.6863	951.281	31.87**	2.13	2.87
P x G	4	6,035.2945	1,508.824	50.55**	2.40	3.38

TABLE 56 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
A. Preliminary Analysis (Cont.)						
Sub-Sub-Plots (Cont.)						
P x T	4	555.3759	138.844	4.65**	2.40	3.38
P x D x G }	12)					
P x T x D }	12)					
P x T x G }	8)344	10,267.8990	29.8485			
P x T x D x G}	24)					
Error (c)	288)					
B. Completed Analysis						
D	3	14,270.8506				
A, B vs. C, D	1		13,361.656	45.54**	4.04	7.19
A vs. B	1		871.779	2.97n.s.		
C vs. D	1		37.416	n.s.		
(D)[b]	3	14,270.8506				
D_L	1		9,213.427	31.38**		
D_Q	1		635.202	2.16n.s.		
Remainder	1		4,422.211	15.06**		
Error (a)	48		293.568			
G	2	17,053.388				
V, C vs. Ck	1		16,264.103	55.40**		
V vs. C	1		789.284	2.69n.s.		
Error (a)	48		293.568			

TABLE 56 -- Continued

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis (Cont.)						
T	2	920.1379				
1, 2 vs. 3	1		19.621	3.88n.s.	3.94	6.90
1 vs. 2	1		900.506	155.72**		
(T)	2	920.1270				
1, 3 vs. 2	1		790.4004	110.46**		
1 vs. 3	1		124.7366	18.10**		
(T)	2	920.1370				
T_L	1		124.7367	18.11**		
T_Q	1		790.4003	110.46**		
T x D	6	182.7798				
T_L x D	3	56.0791	13.0597	1.87n.s.	3.79	3.90
T_Q x D	3	64.2006	21.4003	3.11*		
(T x D)	6	182.7798				
T x D_L	3	80.3238	27.662	4.02*	3.09	4.82
T x D_Q	2	23.0640	11.703	n.s.		
Remainder	3	23.0900	11.945	n.s.		
T x G	4	89.3744				
T_L x G	3	6.1614	3.081	n.s.		
T_Q x G	3	83.1130	41.856	6.03**		
Error (b)	108		6.089			
P	2	64,736.2083				
a, b vs. c	1		64,456.782	2189.46**	3.56	6.73
a vs. b	1		279.410	9.36**		

TABLE 56 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis (Cont.)						
(P)	2	56,736.2882				
P_L	1		55,087.738	1745.87**		
P_Q	1		12,648.468	423.76**		
$P \times D$	6	5,707.6063				
$P_L \times D$	3	4,338.535	1,446.178	68.45**	2.68	3.85
$P_Q \times D$	3	1,369.151	456.384	15.29**		
$(P \times D)$	6	8,787.6068				
$P \times D_L$	2	3,786.3260	1,853.163	68.09**	3.03	4.68
$P \times D_Q$	2	239.2113	119.606	4.01*		
Remainder	2	1,762.1682	881.074	29.82**		
$P \times G$	4	6,035.295				
$P_L \times G$	2	4,678.329	2,337.695	78.32**		
$P_Q \times G$	2	1,359.906	679.953	28.78**		
$P \times T$	4	555.3759				
$P_L \times T$	2	340.1368	170.068	5.72**		
$P_Q \times T$	2	215.2402	107.628	3.61*		
$(P \times T)$	4	558.3739				
$P \times T_L$	2	21.9730	10.986	n.s.		
$P \times T_Q$	2	533.4637	266.782	8.94**		
Error (c)	344		29.8485			

[a]Values corresponding to d.f. for item and respective error.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 67

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR PER CM.[2] STEM AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	Tabular F Values[a] .01
A. Preliminary Analysis						
Total	539	111,884.0654				
Main Plots	59	40,694.2270				
Treatments	11	38,019.4884	3,456.317	13.84**	1.99	2.84
D	3	11,181.3097	3,727.17	16.76**	2.80	4.22
G	2	24,590.2733	12,347.637	55.32**	3.19	5.08
D x G	6	2,142.7024	357.117	1.61n.s.		
Error (a)	48	10,674.7416	222.39			
Sub-Plots	120	1,404.8189				
T	2	585.8374	292.929	54.89**	3.09	4.82
T x D	6	91.7217	15.287	2.86*	2.19	2.99
T x G	4	150.9351	37.734	7.07**	2.84	3.61
T x D x G)	12) 108	576.2967	5.336			
Error (b))	96)					
Sub-Sub-Plots	360	61,403.0270				
P	2	39,699.9620	19,984.998	878.08**	3.03	4.68
P x D	6	4,308.3943	718.084	31.44**	2.13	2.87

TABLE 57 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
A. Preliminary Analysis (Cont.)						
Sub-Sub-Plots (Cont.)						
P x G	4	9,179.4430	2,294.861	100.48**	2.40	3.38
P x T	4	361.0450	90.261	3.95**		
P x D x G	12					
P x T x D	12					
P x T x G	8 (344)	7,856.9832	22.840			
P x T x D x G	24					
Error (c)	288					
B. Completed Analysis						
D	3	11,381.5097				
A, B vs. C, D	1		10,863.1176	48.85**	4.04	7.19
A vs. B	1		140.1408	n.s.		
C vs. D	1		178.2513	n.s.		
(D)[b]	3	11,381.5097				
D_L	1		10,239.079	46.04**		
D_Q	1		1.144	n.s.		
Remainder	1		941.286	42.33**		
G	2	24,735.2733				
V, C vs. Ck	1		24,527.366	110.29**		
V vs. C	1		167.907	n.s.		
Error (a)	48		222.39			

TABLE 57 -- Continued

Source of Variation	d f	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B Completed Analysis (Cont.)						
T	2	585.8574				
1, 2 vs. 3	1		35.518	6.22*	3.94	6.90
1 vs. 2	1		550.339	96.45**		
(T)	2	585.8574				
1, 3 vs. 2	1		542.711	101.71**		
1 vs. 3	1		43.146	8.09**		
(T)	2	585.8574				
T_L	1		43.146	8.09**		
T_Q	1		542.711	101.71**		
T x D	6	91.7217				
T_L x D	3	24.8095	8.270	n.s.		
T_Q x D	3	66.9122	22.304	4.18**	2.70	3.98
(T x D)	6	91.8217				
T x D_L	2	63.5061	31.753	5.95**	3.09	4.82
T x D_Q	2	7.6622	3.831	n.s.		
Remainder	2	20.5534	10.277	n.s.		
T x G	4	150.9351				
T_L x G	2	1.222	.611	n.s.		
T_Q x G	2	149.7131	74.857	14.03**		
Error (b)	108		5.336			
P	2	39,699.9621				
a, b vs. c	1		39,533.362	1722.14**	3.88	6.73
a vs. b	1		166.600	7.26**		

TABLE 57 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B Completed Analysis (Cont.)						
(P)	2	39,699.9621				
P_L	1		31,914.214	1397.3**		
P_Q	1		7,785.748	340.88**		
P x D	6	4,308.3943				
P_L x D	3	3,425.1552	1,141.718	49.99**	2.63	3.85
P_Q x D	3	883.3459	294.415	12.89**		
(P x D)	6	4,308.3943				
P x D_L	2	3,960.0789	1,980.039	86.69**	3.03	4.68
P x D_Q	2	.2963	.148	n.s.		
Remainder	2	348.0191	174.02	7.62**		
P x G	4	9,179.4430				
P_L x G	2	7,241.4473	3,620.724	158.26**		
P_Q x G	2	1,937.9957	968.998	42.43**		
P x T	4	361.0450				
P_L x T	2	190.0063	95.003	4.16*		
P_Q x T	2	171.0387	85.519	3.74*		
(P x T)	4	361.0450				
P x T_L	2	16.5562	8.278	n.s.		
P x T_Q	2	344.4888	172.244	7.54**		
Error (c)	344		22.84			

[a]Values corresponding to d.f. for item and respective error.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 58

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d f	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	839	4,639,181 1431				
Main Plots	59	1,506,750 4330				
Treatments	11	336,989 6058	30,635 419	n s		
D	3	45,832 1816	15,277 394	n s		
G	2	188,356 1979	94,178 099	3,86*	2,80	4 22
D x G	6	102,801 2263	17,133 538	n s		
Error (a)	48	1,169,760 8272	24,370 017			
Sub-Plots	120	251,150 5420				
T	2	10,035 1020	5,017 551	2 52n s,	3 09	
T x D	6	9,278 9014	1,546 484	n s		
T x G	4	16,728 4131	4,182 103	2,10	2,46	
T x D x G)	12) 108	215,108 1255	1,991 742			
Error (b))	96)					
Sub-Sub-Plots	360	2,881,280 1681				
P	2	259,442 6440	129,721 322	17 987**	3 03	4 68
P x D	6	36,168 3684	6,028 061	n s		
P x G	4	82,894 4797	20,723 620	2 87*	2 40	3,38

TABLE 58 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
A. Preliminary Analysis (Cont.)						
Sub-Sub-Plots (Cont.)						
P x T	4	21,948.8230	5,487.206	n.s.		
P x D x G }	12)					
P x T x D }	12)					
P x T x G }	8)344	2,480,825.8530	7,211.703			
P x T x D x G }	24)					
Error (c) }	288)					
B. Completed Analysis						
G	2	188,356.1979				
V, C vs. Ck	1		99,956.116	4.10*	4.04	7.19
V vs. C	1		88,400.082	3.63n.s.		
Error (a)	48		24,370.017			
T	2	10,035.1020				
1, 2 vs. 3	1		8,235.345	4.13*	3.94	6.90
1 vs. 2	1		1,799.757	n.s.		
(T)[b]	2	10,035.1020				
1, 3 vs. 2	1		6,742.752	3.39n.s.		
1 vs. 3	1		3,292.351	1.65n.s.		
(T)	2	10,035.1020				
T_L	1		3,292.350	1.65n.s.		
T_Q	1		6,742.752	3.39n.s.		
T x G						

TABLE 58 -- Continued

Source of Variation	d.f	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B, Completed Analysis (Cont.)						
T x G	4	16,728.4131				
T_L x G	2	10,113.4231	5,056.712	2.54n.s.	3.09	4.82
T_Q x G	2	6,614.9900	3,307.495	1.66n.s.		
Error (b)	108		1,991.742			
P	2	259,442.6440				
a, b vs. c	1		258,829.007	35.39**	3.88	6.73
a vs. b	1		613,637	n.s.		
(P)	2	259,442.6440				
P_L	1		205,189.390	28.45**		
P_Q	1		54,253.254	7.52**		
P x D	6	36,168.3684				
P_L x D	3	15,901.2697	5,300.423	n.s.	2.63	3.85
P_Q x D	3	20,267.0987	6,755.699	n.s.		
P x G	4	82,894.4797				
P_L x G	2	62,850.7910	31,425.396	4.36*	3.03	4.78
P_Q x G	2	20,043.6887	10,021.844	n.s.		
P x T	4	21,948.8230				
P_L x T	2	181.2297	90.615	n.s.		
P_Q x T	2	21,767.5932	10,883.797	n.s.		
Error (c)	344		7,211.703			

[a]Values corresponding to d.f. for item and respective error

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 59

ALTERNATE ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF *WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA[a] FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[b] .05	.01
A. Preliminary Analysis						
Total	503	195,904.9915				
Main Plots	55	41,581.9380				
Treatments	11	21,637.4872	1,967.044	4.33**	2.01	2.68
D	3	1,397.3371	465.779	n.s.		
G	2	16,799.4507	8,399.725	18.53**	3.21	5.12
D x G	6	3,440.6994	573.450	n.s.		
Error (a)	44	19,944.4568	453.283			
Sub-Plots	112	6,961.3719				
T	2	1,449.5450	724.772	14.86**	3.09	4.82
T x D	6	264.2659	44.044	n.s.		
T x G	4	370.8166	92.704	1.90n.s.	2.46	
T x D x G)	12) 100	4,876.7444	48.767			
Error (b))	88)					
Sub-Sub-Plots	336	147,361.6816				
P	2	114,446.5413	57,223.271	756.73**	3.03	4.69
P x D	6	642.3706	07.062	1.42n.s.		

TABLE 59 -- Continued

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
A. Preliminary Analysis (Cont.)						
Sub-Sub-Plots (Cont.)						
P x G	4	7,138.8178	1,784.704	23.60**	2.45	3.38
P x T	4	938.9827	233.988	3.09*		
P x D x G)	12)					
P x T x D)	12)					
P x T x G)	8)320	24,197.9998	78.619			
P x T x D x G)	24)					
Error (c))	264)					
B. Completed Analysis						
G	2	16,799.4507				
V vs. *C[a]	1		6,800.268	18.00**	4.06	7.24
V, *C vs. Ck	1		9,999.183	22.06**		
Error (a)	44		453.283			
T	2	1,449.5450				
1 vs. 2	1		1,379.7141	28.29**	3.94	6.90
1, 2 vs. 3	1		69.8390	1.43n. s.		
$(T)^{a}$	2	1,449.5450				
1 vs. 3	1		128.490	2.63		
1, 3 vs. 2	1		1,321.888	27.09**		
(T)	2	1,449.5450				
T_L	1		128.490	2.63		
T_Q	1		1,321.855	27.09**		

TABLE 59 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis						
T x D	6	264.2659				
T_L x D	3	27.789	9.283	n.s.		
T_Q x D	3	236.507	78.836	1.62n.s.	8.70	
T x G	4	378.5160				
T_L x G	2	289.8972	144.949	8.97n.s.	3.09	
T_Q x G	8	80.9194	40.460	n.s.		
Error (b)	100		48.767			
P	8	114,446.5413				
a <u>vs.</u> b	1		773.986	15.24**	3.87	6.72
a, b <u>vs.</u> c	1		113,672.858	1503.23**		
(P)	2	114,446.5413				
P_L	1		96,604.830	1237.84**		
P_G	1		20,842.511	275.62**		
P x G	4	7,138.8178				
P_L x G	2	6,885.0923	3,002.546	39.71**		
P_Q x G	8	1,133.7252	546.863	7.50**		
P x T	4	935.9527				
P_L x T	2	406.962	203.481	2.69n.s.	3.03	4.66
P_G x T	8	828.991	264.496	3.50*		

TABLE 59 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
(P x T)	4	935.9527				
T_L x P	2	40.5603	20.280	n.s.		
T_Q x P	2	893.3933	447.697	5.92**		
Error (a)	320		75.619			

[a]Three replications for chip bud (*C) treatments instead of four.

[b]Values corresponding to d.f. for item and respective error.

[c]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 40

WATER LOSS PER HOUR (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE (SUM OF FOUR WATERING PERIODS)

A. Water Loss Data

Repli-cation No.	Days after Watering	Time of Day	Type of Graftage (V)	(C)	(S)	(Ck)
1	1	(a)	36.82	38.06	4.56	48.55
		(b)	31.10	28.04	5.05	43.82
		(c)	2.81	2.50	0.00	3.12
	Day subtotal		70.13	68.60	9.61	95.49
	2	(a)	31.16	26.94	15.21	44.40
		(b)	37.78	48.98	10.44	59.26
		(c)	3.24	2.67	0.00	3.78
	Day subtotal		72.18	78.59	25.65	107.44
	3	(a)	34.24	38.18	7.32	47.41
		(b)	29.31	33.14	6.11	41.53
		(c)	2.21	2.21	.63	3.79
	Day subtotal		65.76	73.33	14.06	92.73
Replication total			208.07	219.72	49.32	295.66
2	1	(a)	35.30	20.17	8.37	50.29
		(b)	29.33	12.38	5.60	32.41
		(c)	1.56	.63	.63	5.58
	Day subtotal		66.19	33.18	14.60	88.28
	2	(a)	31.71	15.21	11.81	43.24
		(b)	33.67	23.30	14.88	50.23
		(c)	2.94	1.40	.31	5.62
	Day subtotal		68.32	39.91	27.00	99.09
	3	(a)	30.90	19.23	8.43	46.08
		(b)	28.06	14.72	7.58	37.64
		(c)	2.49	.63	1.27	5.04
	Day subtotal		61.45	34.59	17.28	88.76
Replication total			195.96	107.64	58.88	276.13

TABLE 60 -- Continued

A. Water Loss Data (Cont.) Replication No.	Days after Watering	Time of Day	Type of Graftage (V)	(C)	(S)	(Ch)
3	1	(a)	33.88	11.48	15.57	38.66
		(b)	29.29	9.70	20.70	33.08
		(c)	2.17	.31	1.86	2.17
	Day subtotal		65.34	21.49	38.13	73.91
	2	(a)	32.98	14.17	23.75	38.56
		(b)	44.48	13.21	18.31	45.32
		(c)	1.86	.88	.62	1.88
	Day subtotal		79.32	28.26	42.68	85.73
	3	(a)	38.92	12.37	21.63	36.34
		(b)	26.81	5.32	18.42	35.42
		(c)	2.86	1.32	2.78	3.14
	Day subtotal		65.89	18.85	42.85	74.90
Replication total			212.18	66.58	123.63	234.54
4	1	(a)	29.60	27.58	16.32	53.20
		(b)	36.97	35.84	13.49	71.66
		(c)	2.76	1.88	1.24	7.78
	Day subtotal		69.41	34.92	31.23	132.61
	2	(a)	47.14	32.17	17.85	58.98
		(b)	37.44	28.87	13.36	63.72
		(c)	2.79	1.32	.32	6.01
	Day subtotal		87.37	62.62	31.53	158.71
	3	(a)	39.01	28.47	17.02	66.03
		(b)	36.97	32.07	15.08	78.19
		(c)	3.65	3.10	.91	7.05
	Day subtotal		79.63	63.64	32.98	151.22
Replication total			236.41	161.18	95.74	442.54

TABLE 60 -- Continued

A. Water Loss Data (Cont.) Repli-cation No.	Days after Watering	Time of Day	Type of Graftage (V)	(C)	(S)	(Ck)
5	1	(a)	23.84	.....	.....	27.06
		(b)	26.78	.....	.....	35.80
		(c)	1.86	.....	.....	2.80
	Day subtotal		52.18	.....	.....	55.66
	2	(a)	46.55	.....	.....	32.88
		(b)	33.01	.....	.....	34.37
		(c)	.108	.....	.....	1.89
	Day subtotal		81.41	.....	.....	59.14
	3	(a)	33.57	.....	.....	24.13
		(b)	34.75	.....	.....	20.93
		(c)	3.93	.....	.....	3.07
	Day subtotal		72.24	.....	.....	48.13
Replication total			205.83	.....	.....	162.92
6	1	(a)	.....	.....	.....	31.31
		(b)	.....	.....	.....	30.84
		(c)	.....	.....	.....	4.65
	Day subtotal		.....	.....	.....	72.80
	2	(a)	.....	.....	.....	40.73
		(b)	.....	.....	.....	38.15
		(c)	.....	.....	.....	3.13
	Day subtotal		.....	.....	.....	89.99
	3	(a)	.....	.....	.....	42.84
		(b)	.....	.....	.....	37.23
		(c)	.....	.....	.....	4.28
	Day subtotal		.....	.....	.....	83.88
Replication total			.....	.....	.....	246.34
Totals			1089.42	877.14	327.49	1338.13
Grand Total						3632.18

TABLE 60 -- Continued

B. Type of Graftage vs. Days after Watering Totals (T x G)

Days after Watering	Type of Graftage (V)	(C)	(S)	(Ck)	(T) Totals
1	323.28(15)[a]	175.16(12)	93.89(12)	518.75(18)	1110.78(57)
2	388.90	209.38	126.05	600.10	1324.84
3	347.67	192.60	107.04	539.28	1188.59
(G) Totals	1059.42(45)	577.40(38)	327.49(36)	1658.13(54)	3622.18(171)

C. Type of Graftage vs Time of Day Totals (P x G)

Time of Day	Type of Graftage (V)	(C)	(S)	(Ck)	(P) Totals
(a)	525.02(18)	283.88(12)	155.34(12)	808.21(15)	1782.45(57)
(b)	490.72	273.92	161.91	778.56	1697.11
(c)	38.68	19.34	10.24	74.35	142.62
(G) Totals	1059.42(45)	577.14(38)	327.49(36)	1658.18(54)	3622.18(171)

D. Days after Watering vs. Time of Day Totals (P x T)

Time of Day	Days after Watering 1	2	3	(P) Totals
(a)	544.50(19)	645.68	591.22	1782.45(57)
(b)	520.82	536.45	540.84	1597.11
(c)	45.38	42.74	54.53	142.62
(T) Totals	1115.78(57)	1324.54	1188.59	3622.18(171)

[a]Figures in parentheses denote number of items included in total.

TABLE 61

COMPARISON OF MEAN WATER LOSS PER HOUR, MEAN WATER LOSS PER HOUR PER CM.^{2} STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR PLANTS OF THE MAY 5 GRAFTAGE DATE MAIN TREATMENTS (SINGLE WATERING PERIOD BASIS)

		Water Loss/Hr. (gms.)	Water Loss/Hr./ Cm.^{2} Stem Area (gms.)	Water Loss/Hr. / 10 Dm.^{2} Leaf Area (gms.)
Type of Graftage	(G)			
Veneer graft	(V)	5.89(180)[a]	3.22(180)	7.24(180)
Chip bud	(C)	4.81(144)	2.50(144)	9.44(144)
Shield bud	(S)	2.28(144)	1.29(144)	6.13(144)
Seedling check	(Ck)	7.64(216)	6.60(216)	4.21(216)
Days after Watering	(T)			
	1	4.37(228)	2.57(228)	5.95(228)
	2	5.81	4.80	7.42
	3	5.21	5.66	6.23
Time of Day	(P)			
Morning	(a)	7.82(228)	8.64(228)	9.83(228)
Afternoon	(b)	7.44	5.29	9.09
Evening	(c)	.62	.49	.69
Grand Mean		5.30(684)	2.81(684)	6.54(684)

[a]Figures in parentheses denote number of items per mean.

TABLE 62

MEAN WATER LOSS PER HOUR (GMS.) FOR PLANTS OF THE MAT 5 GRAFTAGE DATE FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(S)	(Ck)	(T) Means
Days after Watering					
1	5.39(60)[a]	3.65(48)	1.98(48)	7.21(72)	6.87(228)
2	6.48	4.36	2.64	8.30	5.81
3	8.80	6.01	2.23	7.49	8.21
(G) Means	8.59(155)	6.01(144)	2.28(144)	7.64(216)	5.30(684)

B. Type of Graftage vs. Time of Day (P x G)

	(V)	(C)	(S)	(Ck)	(P) Means
Time of Day					
(a)	8.75(60)	5.92(48)	3.95(48)	11.23(72)	7.82(228)
(b)	5.26	5.71	3.17	15.77	7.44
(c)	.65	.40	.61	1.03	.63
(G) Means	5.59(160)	4.81(148)	2.28(148)	7.64(216)	5.30(684)

C. Days after Watering vs. Time of Day (P x T)

	1	2	3	(P) Means
Time of Day				
(a)	7.17(76)	8.51	7.75	7.52(225)
(b)	6.58	8.36	7.12	7.44
(c)	.60	.56	.72	.63
(T) Means	4.57(228)	5.51	5.21	5.30(684)

[a]Figures in parentheses denote number of items per mean.

TABLE 63

MEAN WATER LOSS PER HOUR PER CM.^{2} STEM AREA (GMS.) FOR PLANTS OF THE MAY 5 GRAFTAGE DATE FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Type of Graftage vs. Days after Watering (T x G)

Days after Watering	(V)	(C)	(S)	(Ck)	(T) Means
1	3.19(60)[a]	2.36(48)	1.33(48)	6.19(72)	3.87(228)
5	3.57	2.73	1.78	7.34	4.28
3	3.50	2.42	1.51	6.29	3.66
(G) Means	3.32(180)	2.80(144)	1.56(144)	6.60(216)	3.81(684)

B. Type of Graftage vs. Time of Day (P x G)

Time of Day	(V)	(C)	(S)	(Ck)	(P) Means
(a)	4.99(60)	3.61(48)	1.84(48)	9.75(75)	8.64(228)
(b)	4.52	3.88	2.13	9.20	8.29
(c)	.44	.35	.18	.87	.49
(G) Means	3.32(180)	5.50(144)	1.54(144)	6.60(216)	3.81(684)

C. Days after Watering vs. Time of Day (P x T)

Time of Day	1	5	3	(P) Means
(a)	5.30(76)	6.07	5.56	8.84(228)
(b)	4.92	6.86	4.89	5.29
(c)	.49	.48	.85	.49
(T) Means	3.57(228)	4.58	3.66	3.81(684)

[a]Figures in parentheses denote number of items per mean.

TABLE 64

MEAN WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA (GMS.) FOR PLANTS OF THE MAY 8 GRAFTAGE DATE FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Type of Graftage vs. Days after Watering (T x G)

	(V)	(C)	(S)	(Ck)	(T) Means
Days after Watering					
1	6.78(60)[a]	8.63(48)	8.28(48)	4.00(72)	8.95(228)
2	7.98	10.34	7.88	4.76	7.43
3	7.06	9.24	5.27	4.18	6.33
(G) Means	7.24(180)	9.48(144)	6.13(144)	4.31(216)	6.89(684)

B. Type of Graftage vs. Time of Day

	(V)	(C)	(S)	(Ck)	(P) Means
Time of Day					
(a)	10.73(60)	14.49(48)	9.34(48)	6.31(73)	9.83(228)
(b)	10.21	12.80	8.86	6.04	9.09
(c)	.77	.93	.50	.89	.69
(G) Means	7.34(180)	9.48(144)	6.13(144)	4.31(316)	6.89(684)

C. Days after Watering vs. Time of Day (P x T)

	1	2	3	(P) Means
Time of Day				
(a)	9.09(76)	10.81	9.61	9.83(228)
(b)	8.14	10.84	8.29	9.09
(c)	.62	.64	.81	.69
(T) Means	8.95(328)	7.43	6.23	6.89(684)

[a]Figures in parentheses denote number of items per mean.

TABLE 65

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR PER 10 DM.[2] LEAF AREA FOR PLANTS OF THE MAY 8 GRAFTAGE DATE

Source of Variation	Water Loss/Hr.	Water Loss/ Hr. /Cm.[2] Stem Area	Water Loss/ Hr. /10 Dm.[2] Leaf Area
G[a]	8.24[b]	12.20	5.23*
V, C, S vs. Ck	18.87	38.21	10.38
V, C, S	4.87*	n. s.	n. s.
(G)			
V, C vs. S, Ck	n. s.	6.84*	n. s.
V vs. C	n. s.	n. s.	13.22
S vs. Ck	21.94	24.88	n. s.
(G)			
V, Ck vs. C, S	20.89	21.42	5.80*
V vs. Ck	n. s.	14.29	8.72*
C vs. S	n. s.	n. s.	5.11*
(G)			
V, S vs. C, Ck	5.82*	13.59	n. s.
V vs. S	9.08	n. s.	n. s.
C vs. Ck	18.12	19.62	14.87
T	24.84	18.88	5.86
1, 2 vs. 3	n. s.	4.19*	n. s.
1 vs. 2	48.31	24.24	15.39
(T)			
1, 3 vs. 2	43.62	18.70	16.78
1 vs. 3	6.06*	14.41	n. s.
(T)			
T_L	6.06*	14.41	n. s.
T_O	43.62	29.83	16.78
P	328.41	263.98	278.62
a, b vs. c	658.41	525.98	838.45
a vs. b	n. s.	n. s.	2.92*
(P)			
P_L	818.2	422.92	43.89
P_O	138.6	108.04	10.28

TABLE 65 -- Continued

Source of Variation	Water Loss/Hr.	Water Loss/ Hr. /Cm.^{2} Stem Area	Water Loss/ Hr. /10 Dm.^{2} Leaf Area
P x G	14.99	23.78	8.18
P_L x G	23.24	37.74	14.03
P_Q x G	6.74*	9.81	n. s.
P x T	n. s.	n. s.	n. s.
P_L x T	n. s.	n. s.	n. s.
P_Q x T	n. s.	n. s.	4.26*

[a]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

[b]Unless marked otherwise (single-starred or n. s.), the probability level is less than .01.

TABLE 66

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 8 GRAFTAGE DATE OF WATER LOSS PER HOUR FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	Tabular F Values[a] .01
A. Preliminary Analysis						
Total	170	57,848.5233				
Main Plots	18	18,257.9181				
G	3	11,361.3102	3,787.103	8.24**	3.29	5.42
Error (a)	15	6,896.6079	459.774			
Sub-Plots	38	689.3174				
T	2	413.4462	206.723	24.84**	3.52	5.39
T x G	6	26.2208	4.537	n. s.		
Error (b)	30	249.6507	8.322			
Sub-Sub-Plots	114	38,897.2878				
P	2	29,899.2077	14,949.604	328.41**	3.09	4.82
P x G	6	4,093.9052	682.317	14.99**	2.19	2.99
P x T	4	261.8281	65.287	n. s.		
P x T x G }	12} 102	4,483.1487	45.521			
Error (c) }	90}					

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TABLE 66 -- Continued

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	Tabular F Values .01
B. Completed Analysis						
G	3	11,361.3152				
V, C, S vs. Ck	1	7,158.4992	7,158.499	15.57**	4.58	6.60
V, C, S	2	4,252.5115	2,151.406	4.57*	3.68	6.36
(G)[b]	3	11,361.3152				
V, C vs. S, Ck	1	47.1712	47.1712	n. s.		
V vs. C	1	1,127.5574	1,127.557	2.45n. s.		
S vs. Ck	1	10,086.2314	10,086.231	21.94**		
(G)	3	11,361.3102				
V, Ck vs. C, S	1	9,236.5499	9,236.550	25.89**		
V vs. Ck	1		1,259.134	2.74n. s.		
C vs. S	1		856.627	n. s.		
(G)	3	11,361.3108				
V, S vs. C, Ck	1		2,536.515	5.52*		
V vs. S	1		4,173.163	9.08**		
C vs. Ck	1		4,651.329	10.12**		
T	2	413.4462				
1, 2 vs. 3	1		11.349	n. s.		
1, vs. 2	1		402.557	48.31**	4.17	7.56
(T)	2	413.4462				
1, 3 vs. 2	1		362.9926	43.62**		
1 vs. 3	1		50.4536	6.56*		

TABLE 66 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
P	2	29,899.2077				
a, b vs. c	1		29,838.3225	655.41**	2.94	6.90
a vs. b	1		63.8852	n.s.		

[a]Values corresponding to d.f. for item and corresponding error.

[b]Item in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 67

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 5 GRAFTAGE DATE OF WATER LOSS PER HOUR PER CM.^{2} STEM AREA FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .05	.01
A. Preliminary Analysis						
Total	170	38,873.4427				
Main Plots	18	15,331.8138				
G	3	15,576.1713	3,628.3904	12.20**	5.42	
Error (a)	15	4,453.6425	297.542			
Sub-Plots	38	555.7756				
T	2	216.5122	155.561	15.06**	5.39	
T x G	6	74.3215	12.420	1.73n.s.		
Error (b)	38	218.2419	7.175			
Sub-Sub-Plots	114	22,235.8533				
P	2	15,592.3856	7,846.178	263.98**	4.85	
P x G	6	4,578.7672	679.795	23.78**	2.99	
P x T	4	149.5070	37.252	1.30n.s.		
P x T x G }	12} 152	2,918.7235				
Error (c) }	98}					

TABLE 67 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis						
G	3	10,076.1713				
V, C, S vs. Ck	1	9,063.4949	9,063.498	33.21**		
V, C, S	2	1,012.6764	506.338	n.s.		
(G)[b]	3	10,076.1713				
V, C vs. S, Ck	1	1,790.3264	1,790.325	6.04*		
V vs. C	1		211.020	n.s.		
S vs. Ck	1		8,869.010	29.06**		
(G)	3	10,076.1713				
V, Ck vs. C, S	1		6,364.316	31.42**		
V vs. Ck	1		6,243.386	14.29**		
C vs. S	1		268.270	n.s.		
(G)	3	10,076.1713				
V, S vs. C, Ck	1		4,036.328	13.09**		
V vs. S	1		1,812.465	3.41n.s.		
C vs. Ck	1		5,827.385	19.62**		
T	2	216.0122				
1, 2 vs. 3	1		32.2061	4.49*		
1 vs. 2	1		173.896	24.24**		
(T)	2	216.0122				
1, 3 vs. 2	1		112.621	10.70**		
1 vs. 3	1		103.391	14.41**		

TABLE 67 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
(P)	2	10,092.3056				
a, b vs. c	1		15,035.779	825.98**		
a vs. b	1		56.076	n. s.		
P x G	6	4,078.7672				
P_L x G	3	3,273.2051	1,079.068	37.75**		
P_Q x G	3	841.5610	280.021	9.01**		

[a]Values corresponding to d.f. for item and corresponding error.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 68

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 8 GRAFTAGE DATE OF WATER LOSS PER HOUR PER 10 DM.^{2} LEAF AREA FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE), THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values[a] .88	.81
A. Preliminary Analysis						
Total	170	82,751.2441				
Main Plots	18	18,506.3441				
G	3	9,463.1629	3,144.388	8.23*	3.29	5.42
Error (a)	18	9,043.1812	603.879			
Sub-Plots	30	3,461.3054				
T	2	1,128.9468	562.973	8.66**		5.39
T x G	6	328.8644	54.311	n.s.		
Error (b)	30	1,949.4948	64.983			
Sub-Sub-Plots	114	60,543.5946				
P	2	47,813.3878	23,306.694	370.68**		4.82
P x G	6	4,319.8134	703.282	8.18**		2.99
P x T	4	782.8448	188.212	2.17n.s.	2.46	3.51
P x T x G }	12} 102	8,887.8449	86.842			
Error (c) }	90}					

TABLE 48 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis						
G	3	9,463.1629				
V, C, S vs. Ck	1	6,233.3368	6,250.837	10.38**	4.80	8.86
V, C, S	2	3,287.6261	1,603.813	2.66n.s.		
(G)[b]	3	9.463.1629				
V, C vs. S, Ck	1		947.974	n.s.		
V vs. C	1		7,369.053	12.22**		
S vs. Ck	1		1,146.134	n.s.		
(G)	3	9.463.1629				
V, Ck vs. S, C	1		3,016.625	8.00*		
V vs. Ck	1		3,363.301	8.78*		
S vs. C	1		3,082.937	8.11*		
(G)	3	9,463.1629				
V, S vs. C, Ck	1		108.688	n.s.		
V vs. S	1		391.052	n.s.		
C vs. Ck	1		8,964.022	14.87**		
T	2	1,123.9468				
1, 2 vs. 3	1		125.762	n.s.		
1 vs. 2	1		1,000.184	13.39**	4.17	7.56
(T)	2	1,125.9468				
1, 3 vs. 2 (T_Q)	1		1,088.728	16.75**		
1 vs. 3 (T_L)	1		37.221	n.s.		

TABLE 68 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05	.01
B. Completed Analysis (Cont.)						
(T)	2	1,130.9331				
T_L	1		37.221	n.s.		
T_Q	1		1,888.725	16.75**		
P	2	47,013.3878				
a, b vs. c	1		46,760.885	538.45**	2.94	6.90
a vs. b	1		253.216	2.92*		

[a]Values corresponding to d.f. for item and corresponding error.

[b]Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 69

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, WIND MOVEMENT, LIGHT INTENSITIES, SOIL TEMPERATURES, LEAF TEMPERATURES, AND WATER LOSSES/HR. FOR THE MORNING PERIODS OF NINETEEN DAYS IN 1953[a]

Date		Water Loss/Hr. (gms.)	Air Temp. (°C.) (X_1)	V. P. D. (mm.Hg) (X_2)	Wind Movement (10 cu. m./hr.) (X_3)	Light Intensity (lumens/cm.²)[b] (X_4)	Soil Temp. (°C.) (X_5)	Leaf Temp. (°C.) (X_6)
Aug.	12	8.524	32.1	16.27	11.760	2.056	28.9	31.0
	17	6.100	31.0	13.67	3.730	2.277	26.0	31.1
	18	6.747	33.9	18.30	14.923	2.233	29.4	32.0
	20	6.703	32.0	15.79	28.914	6.742	28.2	30.9
	21	9.348	29.9	10.90	40.642	6.668	30.3	30.7
	22	7.438	32.0	16.33	1.607	6.278	26.3	28.0
	24	7.521	32.0	10.19	30.000	2.207	26.2	31.4
	25	6.930	31.6	14.07	87.447	2.000	27.0	31.1
	26	6.022	30.2	12.22	14.070	.592	28.2	31.1
	27	7.080	30.9	12.65	3.020	1.426	27.6	28.0
	28	6.902	29.1	8.97	30.937	1.188	27.3	29.6
	29	1.488	20.6	2.72	1.453	.600	20.5	26.2
	30	4.810	29.3	8.93	.360	2.045	26.3	29.9
	31	2.070	27.0	4.19	22.928	.377	26.1	25.9
Sept.	1	3.467	32.0	16.10	121.490	1.613	28.9	30.2

TABLE 69 -- Continued

Date		Water Loss/Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Wind Movement (10 cu. m./hr.) (X_3)	Light Intensity (lumens/cm.^{2}) (X_4)	Soil Temp. (° C.) (X_5)	Leaf Temp. (° C.) (X_6)
Sept.	2	4.938	35.7	14.15	11.933	1.615	28.9	51.5
	3	5.783	29.6	0.51	.093	.940	26.7	28.5
	4	5.338	32.0	8.51	2.070	.350	27.0	38.1
	5	6.427	29.6	0.51	5.392	2.505	27.0	30.1

[a]Values for air temperatures and vapor pressure deficit were obtained from hygrothermograph records, wind from periodic (three times daily) anemometer readings, light intensities from periodic light meter readings, soil and leaf temperatures, each from twelve thermocouples, and water loss/hr. from the average of sixty plants.

[b]One foot candle = 10.764 x 10^{-4} lumens/cm.^{2}

TABLE 70

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, WIND MOVEMENT, LIGHT INTENSITIES, SOIL TEMPERATURES, LEAF TEMPERATURES, AND WATER LOSSES/HR. FOR THE AFTERNOON PERIODS OF NINETEEN DAYS IN 1953[a]

Date		Water Loss/Hr. (gms.) (Y)	Air Temp. (°C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Wind Movement (10 cu. m./hr.) (X_3)	Light Intensity (lumens/cm.^{2})[b] (X_4)	Soil Temp. (°C.) (X_5)	Leaf Temp. (°C.) (X_6)
Aug.	13	3.075	39.3	10.63	15.730	1.023	30.4	39.3
	17	8.688	36.9	25.93	28.530	3.048	33.0	34.1
	18	4.354	36.6	28.45	6.845	2.368	34.4	53.3
	20	6.958	36.6	25.91	63.930	3.036	28.7	34.1
	21	9.133	36.6	28.42	58.039	3.179	31.5	34.3
	22	4.750	36.3	28.78	7.969	1.426	33.6	33.8
	24	2.523	36.7	18.62	17.445	1.732	31.7	32.3
	25	9.311	36.0	33.76	36.521	3.476	33.0	34.8
	26	5.917	36.0	27.10	21.948	.619	33.0	33.3
	27	10.488	37.2	25.65	19.096	1.453	33.0	35.8
	28	3.210	35.9	17.68	3.342	1.519	30.3	30.4
	29	3.011	30.5	8.97	6.635	.737	36.9	27.4
	30	8.479	33.3	18.85	3.342	1.857	29.0	30.5
	31	5.630	30.3	7.32	34.693	.619	28.4	28.0
Sept.	1	5.852	37.1	27.84	17.768	1.722	28.7	33.0

TABLE 70 -- Continued

Date		Water Loss/Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Wind Movement (10 cu. m. /hr) (X_3)	Light Intensity (lumens/cm.^{3}) (X_4)	Soil Temp. (° C.) (X_5)	Leaf Temp. (° C.) (X_6)
Sept.	2	7.098	38.1	37.84	7.593	3.229	34.0	34.9
	3	5.691	35.0	21.21	2.141	1.138	30.8	31.1
	4	5.991	35.7	33.19	5.393	.431	31.9	33.5
	6	3.907	34.7	34.31	3.999	2.260	32.8	33.4

[a]Values for air temperatures and vapor pressure deficit were obtained from hygrothermograph records, wind from periodic (three times daily) anemometer readings, light intensities from periodic light meter readings, soil and leaf temperatures each from twelve thermocouples, and water loss/hr. from the average of sixty plants.

[b]One foot candle = 10.764 x 10^{-4} lumens/cm.^{3}

TABLE 71

AIR TEMPERATURES, VAPOR PRESURE DEFICITS, WIND MOVEMENT, LIGHT INTENSITIES, SOIL TEMPERATURES, LEAF TEMPERATURES, AND WATER LOSSES/HR. FOR THE EVENING PERIODS OF NINETEEN DAYS IN 1933[a]

Date		Water Loss/Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Wind Movement (18 cu. m. /hr.) (X_3)	Light Intensity (lumens/cm.^{2})[b] (X_4)	Soil Temp. (° C.) (X_5)	Leaf Temp. (° C.) (X_6)
Aug.	13	.419	25.3	4.42	.379	.940	26.8	29.3
	17	.389	27.3	5.18	.045	1.818	29.8	29.1
	18	.428	27.7	6.43	.113	.865	30.2	29.7
	20	.422	27.6	8.72	1.960	1.064	39.6	30.3
	81	.878	29.3	8.86	6.199	.427	29.6	30.6
	22	.669	27.3	8.18	2.623	.318	29.4	29.8
	24	.543	26.6	3.96	.823	.418	28.6	28.8
	25	.643	29.8	8.78	.340	1.833	30.2	30.1
	26	.303	26.3	4.90	.589	.323	29.7	28.1
	87	.860	28.1	8.89	.896	.350	30.3	39.6
	28	.720	86.8	4.19	.326	.391	28.3	87.7
	29	.358	24.8	2.87	.816	.811	86.3	27.8
	20	.345	25.6	3.20	.878	.242	28.1	86.8
	31	.683	26.9	4.39	1.131	.427	37.8	37.6
Sept.	1	.780	27.8	4.83	1.817	.323	20.3	29.6

TABLE 71 -- Continued

Date		Water Loss/Hr. (gms.) (Y)	Air Temp. (° C.) (X_1)	V. P. D. (mm. Hg) (X_2)	Movement (10 cu.m. /hr.) (X_3)	Light Intensity (lumens/cm.^{2}) (X_4)	Soil Temp. (° C.) (X_5)	Leaf Temp. (° C.) (X_6)
Sept.	2	1.010	28.3	5.87	.363	1.803	28.6	27.0
	3	.631	25.8	3.72	.051	.377	28.9	27.0
	4	.266	26.4	4.03	.201	.838	29.3	28.9
	3	.931	26.2	4.55	1.522	.481	29.6	29.7

[a]Values for air temperatures and vapor pressure deficit were obtained from hygrothermograph records, wind from periodic (three times daily) anemometer readings, light intensities from periodic light meter readings, soil and leaf temperatures each from twelve thermocouples, and water loss/hr. from the average of sixty plants.

[b]One foot candle = 10.764 x 10^{-4} lumens/cm.^{2}

TABLE 72

SUMMARY OF CORRELATION COEFFICIENTS, MEANS, PARTIAL REGRESSION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATIONS FOR MORNING, AFTERNOON, EVENING, AND WITHIN PERIODS, OVER NINETEEN DAYS IN 1953[a]

Variable		Morning	Afternoon	Evening	Within Periods[b]
			Correlation Coefficients		
Total:	$R_{y.123456}$	.7495*	.7728*	.5716*	.5722**
Partial:	$r_{y1.23456}$	.2056	.4406	.4246	.1207
	$r_{y2.13456}$	.3092	.3810	.1125	.1567
	$r_{y3.12456}$	.0079	.4048	.1046	.1759
	$r_{y4.12356}$	.2027	.1472	.0003**	.0008
	$r_{y5.12346}$	.3340	.3353	.0765	.0389
	$r_{y6.12345}$	.3784	.4165	.2399	.2393
Simple:	r_{y1}	.0079*	.5766	.4704*	.4576**
	r_{y2}	.5127*	.0145*	.4595*	.5049**
	r_{y3}	.1041	.4856*	.3406	.2592
	r_{y4}	.4179	.2761	.1013	.3344**
	r_{y5}	.6427**	.5636	.2832	.4136**
	r_{y6}	.6074**	.0179*	.1613	.5240**
			Means		
$\overline{X}_1$ (Air temp., °C.)		30.9	35.1	26.9	31.0
$\overline{X}_2$ (V. P. D., mm. Hg)		11.96	21.92	5.11	15.00
$\overline{X}_3$ (Wind movement, x 10 cu. m./hr.)		23.20	19.72	.94	14.601
$\overline{X}_4$ (Light intensity, lumens/cm.^{2})		1.889	1.707	.606	1.401
$\overline{X}_5$ (Soil temp., °C.)		37.8	31.8	29.0	29.0
$\overline{X}_6$ (Leaf temp., °C.)		30.2	32.5	28.7	30.4
$\overline{Y}$ (Water loss/hr., gms.)		6.06	5.00	.60	4.16

TABLE 72 -- Continued

Variable	Morning	Afternoon	Evening	Within Periods[b]
		Partial Regression Coefficients		
$b_{y1.23456}$	.39433	-.34616	.16674	-.19534
$b_{y2.13456}$	-.34914	.33555	.53044	.11575
$b_{y3.12456}$	.50034	.03156	.53314	.51114
$b_{y4.12356}$	.30968	-.31255	1.15053	.15351
$b_{y5.12346}$	.59697	-.41527	.52234	-.55874
$b_{y6.12345}$	.67543	1.31287	-.55055	.42157

Multiple Regression Equations

Morning: $\hat{Y} = .394\,X_1 - .349\,X_2 + .50536\,X_3 + .3097\,X_4 + .597\,X_5 + .675\,X_6 - 39.537.$

Afternoon: $\hat{Y} = 6.95 - .846\,X_1 + .255\,X_2 + .5316\,X_3 - .313\,X_4 - .613\,X_5 + 1.313\,X_6.$

Evening. $\hat{Y} = .167\,X_1 + .0304\,X_2 + .5331\,X_3 + 1.155\,X_4 + .5253\,X_5 - .5551\,X_6 - 3.955.$

Within Periods: $\hat{Y} = -3.525 - .190\,X_1 + .114\,X_2 + .5111\,X_3 + .1535\,X_4 - .5557\,X_5 + .422\,X_6.$

[a]Tabular values for R or r:

d.f.	No. Variables	.05	.01	
12	7	.722	.802	Morning, Afternoon, Evening
17	3	.454	.575	
47	7	.432	.501	Within Periods
53	3	.373	.352	

[b]Since the analysis is run on water loss/hr. and environmental factors within each periods, the degrees of freedom are (19 - 1) + (19 - 1) + (19 - 1) = 34 total; for (n - 7), d.f. = 47; for (n - 2), d.f. = 53.

TABLE 73

TESTS OF SIGNIFICANCE FOR THE PARTIAL REGRESSION COEFFICIENTS EXPRESSING THE RELATIONSHIPS OF WATER LOSS PER HOUR ON SIX ENVIRONMENTAL FACTORS, COMPARING PAIRS OF PERIODS (MORNING, AFTERNOON, AND EVENING), IN 1953

Independent Variable	Comparison	Difference between Partial Regression Coefficients	Standard Error of Difference	t[a]
Air temp. (X_1)	morning vs. afternoon	1.240485	.6561	1.591 (.09)
$b_{y1.23456}$	morning vs. evening	.227588	.4397	.515
	afternoon vs. evening	-1.012597	.5051	1.993 (.07)
V. P. D. (X_2)	morning vs. afternoon	-.604184	.3172	1.903 (.58)
$b_{y2.13456}$	morning vs. evening	-.379581	.2731	1.390 (.25)
	afternoon vs. evening	-.224603	.1911	1.151 (.25)
Wind (X_3)	morning vs. afternoon	-.031198	.5773	.404
$b_{y3.12456}$	morning vs. evening	-.032775	.0625	.524
	afternoon vs. evening	-.001580	.5645	.325
Light intensity (X_4)	morning vs. afternoon	.622224	.7443	.536
$b_{y4.12356}$	morning vs. evening	-.570336	.4775	1.823 (.59)
	afternoon vs. evening	-1.492580	.6395	2.334* (.04)
Soil temp. (X_5)	morning vs. afternoon	1.212242	.6962	1.741 (.1)
$b_{y5.12346}$	morning vs. evening	.574631	.4926	1.167 (.25)
	afternoon vs. evening	-.637611	.5061	1.260 (.22)
Leaf temp. (X_6)	morning vs. afternoon	-.637439	.9543	.668
$b_{y6.12345}$	morning vs. evening	.725976	.4806	1.511 (.15)
	afternoon vs. evening	1.363415	.5287	1.645 (.13)

[a]Values in parentheses indicate approximate probability of t; d.f. = 12; $t_{.05}$ = 2.179.

TABLE 74

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND AIR TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1955

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d.f.	Sums of Squares and Products Sx_1^2	Sx_1y	Sy^2	Errors of Estimate Sum of Squares[a]	d.f.	Mean Square
Day (total)	56	903.60	493.50	504.231	477.279	55	
Periods	2	647.88	409.73	360.946			
Within periods	54	255.72	83.77	143.285	115.843	53	2.186
For test of significance of adjusted period means					361.436	2	180.718**

$$F = \frac{180.718}{2.186} = 82.67$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	143.285	2.653	
Reduction due to regression, $(Sx_1y)^2/Sx_1^2$	1	37.442	37.442**	12.64
Error for adjusted means	53	115.843	2.186	

TABLE 74 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d. f.	Sums of Squares and Products Sx_1^2	Sx_1y	Sy^2	Errors of Estimate Sum of Squares	d. f.
Morning	18	79.80	39.20	62.476	43.855	17
Afternoon	15	148.80	42.20	79.900	67.932	17
Evening	18	27.92	2.37	.909	.700	17
Sums	54	285.72	83.77	143.285	111.665	51

Source of Variation	d. f.	Errors of Estimate Sum of Squares	Mean Square
Deviations from average (error) regression within periods	53	115.843	
Deviations from individual period regressions	51	111.665	2.190
Differences among period regressions	5	4.178	2.089n. s.

[a] $Sy^2 - (Sx_1y)^2/Sx_1^2$

TABLE 75

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND VAPOR PRESSURE DEFICITS IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1953

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d. f.	Sums of Squares and Products Sx_2^2	Sx_2y	Sy^2	Errors of Estimate Sum of Squares[a]	d. f.	Mean Square
Day (total)	56	3897.00	982.68	504.331	866.576	55	
Periods	2	2715.59	774.68	360.46			
Within periods	54	1181.41	207.72	143.285	106.763	53	2.014
For test of significance of adjusted period means					159.813	2	79.957**

$$F = \frac{79.957}{2.014} = 39.68$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	143.285	2.653	
Reduction due to regression, $(Sx_2y)^2/Sx_2^2$	1	36.522	36.522**	18.18
Error for adjusted means	53	106.763	2.014	

TABLE 78 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d.f.	Sums of Squares and Products Sx_2^2	Sx_2y	Sy^2	Errors of Estimate Sum of Squares	d.f.
Morning	18	331.60	73.80	62.476	46.851	17
Afternoon	18	816.40	131.40	79.988	88.781	17
Evening	18	33.41	2.82	.909	.719	17
Sums	54	1181.41	207.72	143.285	188.521	51

Source of Variation	d.f.	Errors of Estimate Sum of Squares	Mean Square	F
Deviations from average (error) regression within periods	53	159.813		
Deviations from individual period regressions	51	105.821	2.069	
Differences among period regressions	2	54.292	27.146**	13.12

$^a Sy^2 - (Sx_2y)^2/Sx_2^2$

TABLE 76

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND WIND MOVEMENT IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1983

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d.f.	Sums of Squares and Products Sx_3^2	Sx_3y	Sy^2	Errors of Estimate Sum of Squares[a]	d.f.	Mean Square
Day (total)	56	31,996.78	1900.40	804,231	391,359	55	
Periods	2	8,449.14	1394.98	360,946			
Within periods	54	26,547.56	505.42	143,288	133,663	53	2,822
For test of significance of adjusted period means					287,696	2	128,848**

$$F = \frac{128,848}{2,822} = 51.09$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	183,288	2,653	
Reduction due to regression, $(Sx_3y)^2/Sx_3^2$	1	9,622	9,622	3.81n.s.
Error for adjusted means	53	133,663	2,822	

TABLE 76 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d. f.	Sums of Squares and Products Sx_3^2	Sx_3y	Sy^2	Errors of Estimate Sum of Squares	d. f.
Morning	18	18,353.30	111.50	62.476	61.799	17
Afternoon	18	8,103.40	391.90	79.908	61.063	17
Evening	18	38.66	2.02	.989	.803	17
Sums	54	26,547.56	505.42	142.283	123.665	51

Source of Variation	d. f	Errors of Estimate Sum of Squares	Mean Square
Deviations from average (error) regression within periods	53	133.663	
Deviations from individual period regressions	51	123.665	2.425
Differences among period regressions	2	9.998	4.999n. s.

D. Analysis of Error of Estimate from Three Regressions

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Day (total)	55	391.359		
Period means[b]	1	3.531	3.531	
Average within periods	53	133.663	2.522	
Remainder	1	253.865	253.865**	100.66

[a] $Sy^2 - (Sx_3y)^2/Sx_3^2$

[b] Obtained from line two of A. Analysis.

TABLE 77

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND LIGHT INTENSITIES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1953

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d. f.	Sums of Squares and Products Sx_4^2	Sx_4y	Sy^2	Errors of Estimate Sum of Squares[a]	d. f.	Mean Squares
Day (total)	56	55, 00	105, 20	524, 231	302, 012	55	
Periods	2	18, 33	80, 95	360, 946			
Within periods	54	36, 67	24, 24	163, 285	127, 262	2	2, 401
For test of significance of adjusted period means					175, 750	53	87, 875**

$$F_{,} = \frac{87,875}{2,401} = 36\ 60$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	143, 288	2, 653	
Reduction due to regression, $(Sx_4y)^2/Sx_4^2$	1	16, 023	16, 023**	6, 67
Error for adjusted means	53	127, 262	2, 401	

TABLE 77 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d.f.	Sums of Squares and Products Sx_4^2	Sx_4y	Sy^2	Errors of Estimate Sums of Squares	d.f.
Morning	18	20.96	15.18	62.476	51.866	17
Afternoon	18	13.88	8.98	79.900	73.807	17
Evening	18	2.77	.24	.909	.588	17
Sums	54	36.67	24.24	143.285	126.261	51

Source of Variation	d.f.	Errors of Estimate Sum of Squares	Mean Square
Deviations from average (error) regression within periods	53	127.262	
Deviations from individual period regressions	51	126.261	2.476
Differences among period regressions	2	1.001	.501n.s.

D. Analysis of Error of Estimate from Three Regressions

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Day (total)	55	303.012		
Period means[b]	1	3.362	3.362	n.s.
Average within periods	53	127.262	2.401	
Remainder	1	172.388	172.388**	71.80

[a] $Sy^2 - (Sx_4y)^2/Sx_4^2$

[b] Obtained from line two of A. Analysis.

TABLE 78

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND SOIL TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1983

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d. f.	Sums of Squares and Products Sx_s^2	Sx_sy	Sy^2	Errors of Estimate Sum of Squares[a]	d. f.	Mean Square
Day (total)	56	284.38	151.30	504.231	468.162	58	
Periods	2	160.36	46.13	369.946			
Within periods	54	124.14	55.17	163.258	118.766	53	2.241
For test of significance of adjusted period means					349.386	2	174.693**

$$F = \frac{174.693}{2.241} = 77.98$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	143.285	2.653	
Reduction due to regression, $(Sx_sy)^2/Sx_s^2$	1	24.319	24.519**	15.94
Error for adjusted means	53	118.766	2.241	

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d. f.	Sums of Squares and Products Sx_5^2	Sx_5y	Sy^2	Errors of Estimate Sum of Squares[a]	d. f.
Morning	18	26. 80	26. 30	62. 476	36. 667	17
Afternoon	18	71. 60	27. 30	79. 900	60. 338	17
Evening	18	25. 74	1. 37	. 909	. 836	17
Sums	54	124. 14	55. 17	143. 285	186. 841	81

Source of Variation	d. f.	Errors of Estimate Sum of Squares	Mean Square	F
Deviations from average (error) regression within periods	53	118. 766		
Deviations from individual period regressions	81	186. 841	2. 098	
Differences among period regressions	2	11. 928	5. 963	n. s.

[a] $Sy^2 - (Sx_5y)^2/Sx_5^2$

TABLE 79

ANALYSES OF COVARIANCE FOR WATER LOSSES PER HOUR AND LEAF TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1953

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d. f.	Sums of Squares and Products Sx_6^2	Sx_6y	Sy^2	Errors of Estimate Sum of Squares[a]	d. f.	Mean Square
Day (total)	56	293.15	245.90	504.231	297.930	55	
Periods	2	124.56	164.47	360.946			
Within periods	54	168.54	81.43	143.285	103.942	53	1.961
For test of significance of adjusted period means					193.988	2	96.994**

$$F = \frac{96.994}{1.961} = 49.46$$

B. Increase of Precision in Analysis of Error Variance

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, Sy^2	54	143.285	2.653	
Reduction due to regression, $(Sx_6y)^2/Sx_6^2$	1	39.343	39.343**	20.06
Error for adjusted means	53	103.942	1.961	

TABLE 79 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimate from the Average Regression Within Periods

Source of Variation	d. f.	Source of Variation Sx_6^2	Sx_6y	Sy^2	Errors of Estimate Sum of Squares	d. f.
Morning	18	50.70	57.00	62.476	35.474	17
Afternoon	18	58.70	43.60	79.900	58.469	17
Evening	18	29.14	.53	.909	.858	17
Sums	54	168.54	81.43	143.258	94.825	51

Source of Variation	d. f.	Errors of Estimate Sum of Squares	Mean Square	F
Deviations from average (error) regression within periods	53	103.942		
Deviations from individual period regressions	51	94.828	1.859	
Differences among period regressions	2	9.114	4.557	n. s.

$^{a}Sy^2 - (Sx_6y)^2/Sx_6^2$

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Mortimer James Soule, Jr., was born in Bradford, Pennsylvania, on January 3, 1920. He received his elementary and secondary education at St. Petersburg, Florida. In September, 1936, he entered Hobart College, Geneva, New York. He transferred in September, 1938, to the New York State College of Agriculture, Cornell University, from which he graduated with the B. S. degree in February, 1941. He entered the Cornell Graduate School imediately after graduation and remained there until June, 1942. He was appointed Assistant in Surveying, Department of Agricultural Engineering, in January, 1942.

From March, 1943, to March, 1946, he worked for Eastman Kodak Company, Rochester, New York. From April, 1946, to January, 1949, he operated a landscape maintenance and engineering firm in St. Petersburg, Florida.

In February, 1949, he was admitted to the Graduate School, University of Miami; he received the M. S. degree in February, 1951. From February to August, 1951, he was Research Assistant, W. T. Swingle Citrus Research Project.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Agriculture and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 7, 1954

C. V. Noble

Dean, College of Agriculture

Dean, Graduate School

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